OCTOBER 1930—SECTION II

IN TWO SECTIONS

RADIO

REG.U.S.PAT.OFF.

THIS SECTION OF "RADIO" IS SENT TO ALL SUBSCRIBERS TO THE MAGAZINE AS A PART OF THEIR REGULAR SUBSCRIPTION

A New Test Panel for the Shop

In which several new ideas are introduced: Rectifier Meter, Speaker Comparison, Pick-up Comparison, Eliminator Load, Superheterodyne i-f Oscillator.

By J. EDWARD JONES

THERE is a crying need by the average small dealer for an adequate, yet inexpensive panel for the shop bench. A canvass of twenty-five average dealers proved that the panel described herein fills this long-felt want. Properly built it will prove an asset to any shop, and where only a reasonable amount of service work is done it will not only pay for itself in a few months, but will remain a lasting time-saver for many years.

In the design and layout every need has been taken into consideration, based upon the operation of a large distributor's shop, and the expressed needs of many dealer service men over a period of years.

No attempt has been made to introduce a set analyzer into the panel, as all dealers have one or more portable analyzers, and it is an acknowledged fact that every set entering the shop, granting it has been properly checked in the home, must be removed from its cabinet, thereby rendering all parts accessible for measurement and test. In addition, and as part of shop equipment, the dealer should have a speaker mounted suitably, above the panel and properly baffled, a turntable and a standard pickup.

Let us build the panel, then see what can be done with it. First collect the material, not forgetting the junk drawer, or old trade-in sets piled up in the back room. We need a bakelite panel 22″x15″x$\frac{3}{16}$″. It would be nice to have it engraved, and with the dealer's own name in the center, as it would create quite an impression on customers who were accidentally allowed to see it.

The one meter is a comparativly new development and can be obtained from the Weston Instrument Company, the General Electric Company or the General Radio Company, or, should the builder so desire, a copper oxide rectifier could be obtained and used in conjunction with any standard one milliampere meter. To allow utter flexibility of purpose we will leave the scale readings, therefore current shunts and series voltage resistors to the choice of the individual. The drawings show suggested current and voltage readings.

A word of caution is sounded by the Weston Company, who feel that the copper oxide rectifier meter's use is limited to the laboratory. They say it has limitations due to frequency change, wave form and temperature. There is quite an effective variation in the resistance of the rectifier as the current swings the needle from zero to maximum deflection. This, however, is taken care of in the scale of the meter, and while it makes calculation of shunt resistances difficult, it will cause no appreciable error if shunts are "fitted" to the meter by the comparison method. This method merely consists of hooking another ammeter in series with the one to be shunted and clipping the shunt resistance until the indicators of the two meters read alike. Because resistances in meters vary, and because even if the proper resistance for the shunt is determined, which would require a Wheatstone bridge (and then the resistance of the soldered joint would upset the apple cart all over again), the comparison method is the only practicable method for the service man. If the extra meters for comparison are not available in the shop they certainly should be "borrowable," either from the nearest competitor or a high school laboratory.

Special attention is called to the current jacks marked A to E inclusive. The connections are made so that the shunt is closed before the meter circuit so as to protect the meter at all times. The voltage jacks, F to J inclusive, are simple open circuit jacks. Yaxley No. 1 type will be found very satisfactory.

To follow the alphabet we next come to the ohmmeter continuity tester. K is a Yaxley No. 3 filament control jack. It puts 1 ohm across the meter to allow measurements of low resistances. This low reading is a little hard on the 771 C battery used in conjunction with it, but the battery lasts many months, and with this arrangement it is possible to measure and read with ease as low as 5 ohms. The high side L, No. 1 Yaxley open circuit jack, uses no shunt and the meter gives an easily definable deflection at a quarter of a megohm. The low side uses a Yaxley 400-ohm variable resistance, and the high side a Yaxley 5000-ohm variable resistor. These are the series resistors, and if set before each reading the results must be accurate. The method for setting is to short probe tips and adjust to maximum deflection of

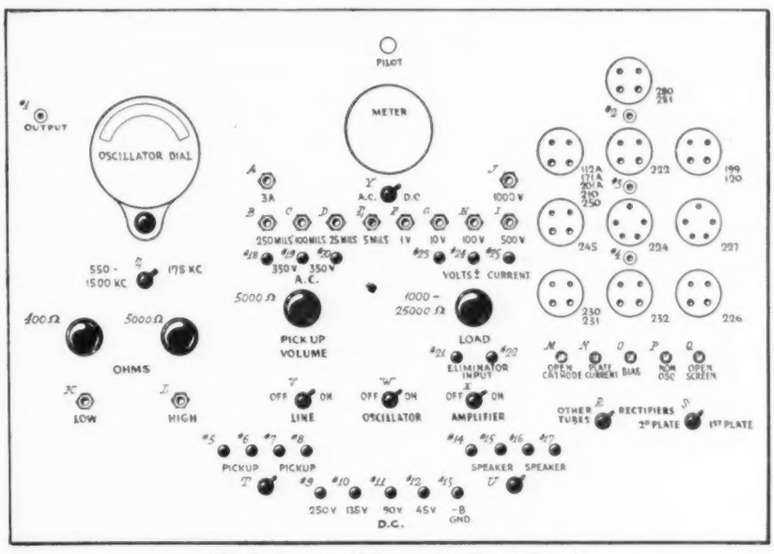


Fig. 2. Suggested layout for Front Panel

meter. This is done to offset any change of voltage in the battery. It is merely a simple problem in Ohm's law. Current equals voltage divided by resistance; therefore, if our voltage drops a trifle we drop the resistance in like proportion and our current remains the same. The builder should plot a curve, using known values to obtain as many points as possible.

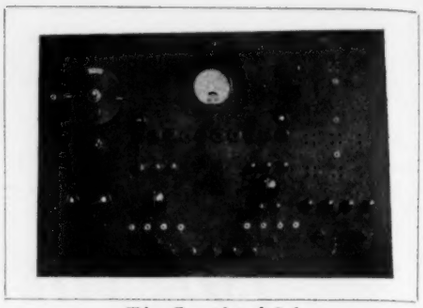
The Tube Tester

Ten sockets are used in the tube tester, seven UX and three UY. The lone socket on top is for rectifiers and is operated in conjunction with switches R and S. The switch R is merely thrown to the desired position and the switch S manipulated to get each plate of a 280. Switch R is so connected that a shunt allowing a measurement of about 100 ma is used. The filament of this socket goes to a five-volt winding on the power transformer, taps from which are taken off for the pilot light. The next row of three sockets are UX, their filament terminals being connected to the same five-volt winding. The inner left-hand one gets the full five volts, being used for all the five-volt tubes, as well as for the 210s and 250s. The other two sockets of this row are connected through a resistance of six ohms in each leg. The middle socket of this row is used in conjunction with Yaxley pup jack marked No. 2 to test UX 222 screen grid tubes, and the right-hand one is for 199s and 120s.

The next row of three are 2½-volt sockets, the first, a UX, is for 245s, the second, a UY, in conjunction with Yaxley pup jack No. 3, is for 224s, and the other UY for 227s. The left and center of the bottom row are for the 2-volt tubes. The filaments of these 2 UX sockets are tapped across the 2½-volt winding through 2½ ohms of resistance in each leg. The first is for 230s and 231s, the middle one, in conjunction with Yaxley pup jack No. 4, is for the UX 232 screen grid 2-volt tube. The filament of the right-hand socket is also tapped across the 2½-volt winding, but through resistances of ½ ohm in each leg. This is for the 226.

Push buttons M to Q inclusive operate the tester. M and Q are buttons normally closed, N is a button normally open, while O and P are single pole double throw, or "break one-make one" buttons. Tubes are tested first in an oscillating condition. The oscillating coils are plainly indicated. Those as used in Radiola 25 are recommended with a .004 μf condenser across the grid coil. Pressing button N puts a particular shunt in action on the meter, which should be such as to give about 25 mils full scale. Meter now reads plate current with tube oscillating; this reading should be noted. Then with another finger press button P. Note reading. The difference between it and first reading is a direct indication of the sensitivity of the tube with oscillatory current on the grid. Low plate impedance power tubes give only small difference. Now release P and press O, and again note reading. The difference now is the change in plate current with 9 volts d-c impressed on the grid and is a direct indication of its amplification factor, or so-called sensitivity. For tubes with indirectly heated cathodes, such as 227s and 224s, hold down on button N and press button M. If reading remains the same the tube's cathode is shorted to its heater. For all screen grid tubes, while still pressing N, press Q also. If reading remains the same, there is a screen plate short. This is an excellent test for tubes. While lengthy description is required, in practice it is very rapid. Push buttons can be obtained at all meter manufacturers or can be made from old jacks. It is recommended that the builder test several known good tubes of each type and keep the three readings until he becomes familiar with the variations. Tubes giving good readings on this tester will give excellent service, and if all tubes are tested before being put in a new installation, many free service calls will be eliminated and generally greater satisfaction obtained by the customer.

Next we come to switches T and U, both single-pole double-throw toggles. Both work in conjunction with four binding posts or pup jacks. Very few dealers have a set hooked up at all times, yet speakers will persist on coming in for repair or adjustment. Also the repair, test and adjustment of pickups is on the increase. Hence our recommendation for a standard pickup and turntable and a standard properly mounted speaker as part of shop equipment. Pickups can be repaired, then compared with the standard on the same record, amplifier and speaker by merely flipping switch T. The repaired speaker also can be tested and compared, using same pickup, record and amplifier, by merely throwing switch U.



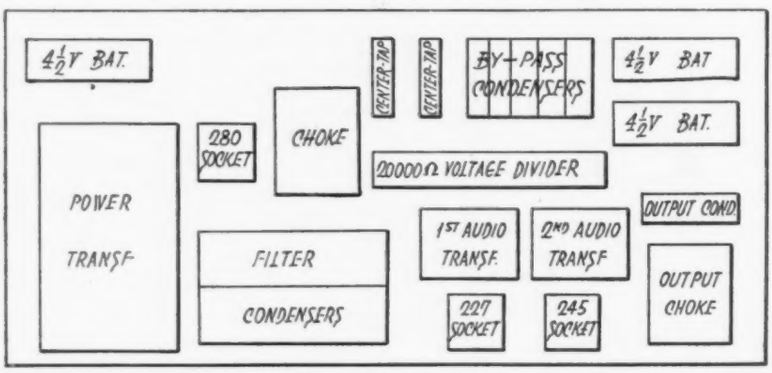
The Completed Job

Switch V turns on the 110 a-c, and must be on when any power is used from the panel, such as tube tester, amplifier, oscillator and a-c and d-c voltages. It can be off when using continuity circuit, when using the meter for straight measurement, or when testing load output of eliminators and power packs.

Switch W turns on the filament of the modulated oscillator and switch X turns on the filaments of the two amplifying tubes. Either of these may be off when their respective appliances are not in use. They, like V, are merely on and off toggles.

Switch Y is also an on and off toggle and is used in conjunction with the meter. It is thrown to a-c if alternating voltages or currents are to be measured, and vice versa. Full instructions for operating this come with each meter.

The oscillator needs little comment. The circuit is self-explanatory. While GR coil 277 C is recommended, any r-f transformer secondary may be used, just by tapping it at the center turn. It makes no difference how large or small it is, or how large the wire is, or how many turns there are, as long as it was once a good r-f coil and covered the broadcast band with a .0005 μf variable condenser. For the low frequency coil, to give 175 kc for RCA superheterodyne intermediates, 200 turns of No. 30 DSC wound on a two-inch form, with an XL .0001 to .0005 μf adjustable condenser shunted across the coil ahead of the switching arrangement, is recommended. This gives quite a range each side of 175, can be shifted up or down, and will undoubtedly cover other makes of supers that will make their appearance on the market during the coming season. A Radiola 60 intermediate with trimmer and neutralizing condensers removed makes a pretty good makeshift 175 kc oscillator coil for this arrangement. For the grid condenser



Subpanel Layout

and leak, while values shown have been used with satisfactory results, a different pitched note may be obtained by different combinations. Generally the higher the resistance of the grid leak the higher the frequency of the modulated note. The switch Z is a double-pole double-throw Yaxley jack switch, and changes from the broadcast band to 175 kc and vice versa. The pickup coils consist of 5 turns wound on the plate end of each coil, one end left open, the other end taken to Yaxley pup jack No. 1. Various ways of pickup can be tried. A wire between pup jack and antenna post of set will give a terrific signal in the broadcast band, or an open-ended coil can be plugged into the pup jack and the coil then brought into juxtaposition with one or other coils in the set being aligned. For gain indication the meter is used, connection being made to the output of the set, clipped across the voice coil if accessible and plugged into any jack from A to J, whichever gives the best reading. The meter will be found an excellent gain indicator, and as alignment increases the output scales of higher value may be used, saving manipulation of the set's volume control or the oscillator output.

Remember, fifty per cent of the sets in use today would give better results if properly aligned, and many sales have been lost to a competitor because his was better balanced, even though accidentally. Alignment means distance and selectivity, and as a specialty can be developed into a lucrative source of income to the well appointed service department.

We have mentioned Yaxley pup jacks 1 to 4. Numbers 5 to 25 can be either the same pup jacks or binding posts, whichever the builder desires. Numbers 5 to 8 are used with switch T aforementioned, as are 14 to 17 with switch U. Numbers 9 to 13 are merely extensions of taps on the voltage divider and are arranged to give various voltages d-c that may at times be necessary for flash tests on condensers, etc. Numbers 18 to 20 give high voltage a-c, 19 being ground and 18 and 20 being connected to the rectifier plates in the power supply. Therefore, between 19 and 20 or 19 and 18 we obtain half the voltage of the high voltage secondary, or approximately 350 volts a-c, while between 18 and 20 we get the full voltage, or about 700 volts a-c. Uses for this appendage will suggest themselves, for instance, a capacity measurement. Connect a known value of condenser, say 1 μf, in series with one 350-volt side and about the 100-mil scale of the meter, a certain definite reading will be obtained. Do this with various sized condensers of known value and you can plot a curve that will then give reasonably accurate measurements on unknown condensers. As a warning, it is advisable to make sure the condenser is not shot before attempting to test it.

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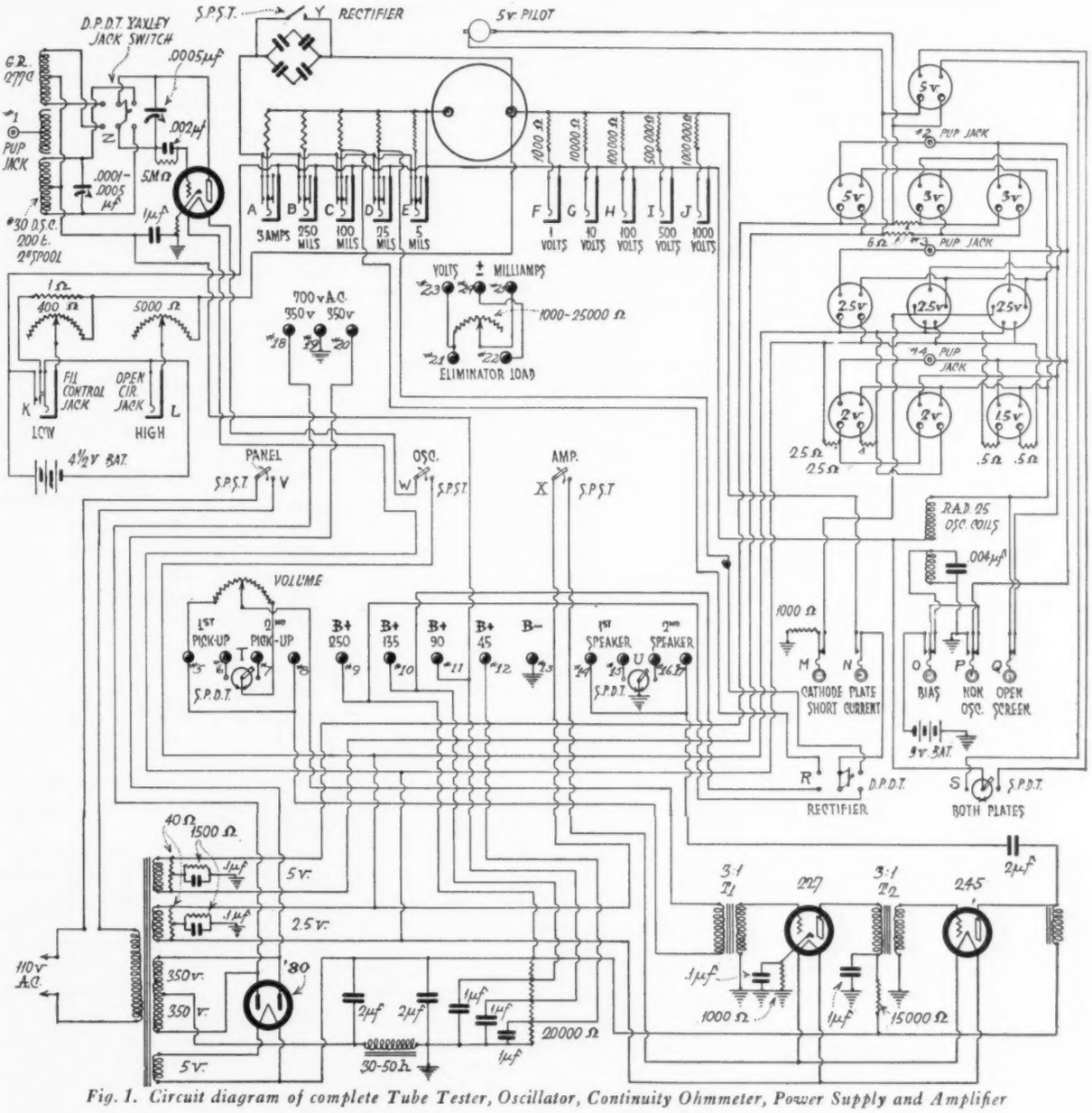

Fig. 1. Circuit diagram of complete Tube Tester, Oscillator, Continuity Ohmmeter, Power Supply and Amplifier

There Are *Times*—

A truck salesman argues that sometimes a radio service man should take a receiver down to the shop for repair.

By **WM. R. PHILLIPS**

"NO BUSINESS, Mr. Johnson. I have no use for a truck, light or heavy, four wheels, eight wheels or pin-wheels. The only thing I need transportation for are my own carcass and my nine-by-twelve service kit, and these things fit just beautifully in the enhancing phaeton that has carried them around for going on ten years." And Radio Smithy stoked his pipe with filings from his twist. "If the old boat ever falls apart under me I'll get even more democratic and buy me a motorcycle. Save gas, oil, air, water and rubber. And the only advantage a truck would have would be in carrying a big sign around town, as if the view wasn't already spoiled enough by such unsightly sights."

"Of course I don't know much about the radio service business, Mr. Smith," said the truck salesman, "but it strikes me that it is often necessary to take a set down to the shop and work on it, in which case a truck would be—"

"Not me, it ain't!" asserted the smithy. "Why? Because I know my stuff, that's why. In all my experience I've never come across a set yet that stumped me. Give 'er a lissen and get the symptoms, stick on the tester and find the cause, then rip her up and stick in a new condenser or resistor and put her back together just like the doc does to an appendicitis victim."

"Why does the doctor always haul his victims to the hospital, then?" queried Mr. Johnson.

"So he can soak 'em room rent and nurse hire. That's just the trouble; he builds himself a hospital and then he has to pay for it, and when a man's works goes wrong he's the guy that has to pay the doctor's bills for him. Every time he takes a joy ride in an ambulance he pays the monthly installment on the hack. And that's the way with radio service men who fix up a swell shop and buy a high-toned truck. They have to have the truck to drag the set down to the shop so they can use their fine gear. Then the poor goof who has trouble with his radio set has to cough up alms to pay for the shop and the truck, too."

"Did you ever get a spot on anyone's rug?" Mr. Johnson asked.

"Oh, what's a rug? Cost you twenty bucks and last a lifetime. A little spot don't hurt 'em any."

"The kind of rugs you and I buy cost twenty bucks, but some people spend a hundred or maybe a thousand dollars for one, and they're usually pretty particular about 'em."

"A thousand dollars for one rug?" Radio Smithy guffawed loud and long. "For a thousand bucks you could put rugs all up and down Main Street. Wait'll I answer this phone."

"Hello!"

(Animated female voice vibrating receiver diaphragm.)

"Why, sure, Mrs. Applegate. It only took me ten minutes, but I had to go all the way out there and back. My minimum charge for a call is two-fifty."

(More vibrations.)

"No, I didn't put any new parts into it, but I would of if I had been one of these dumb clucks with a fancy wagon and no brains."

(Rattling sound, like overloaded speaker.)

"Well, make it a dollar and a half. Sure was worth that much. O. K., Mrs. Applegate. Goodbye."

"Can you beat that? If I'd fussed around awhile and spent a couple of hours unscrewing things and screwing 'em up again I could of collected five bucks. Some people don't appreciate brains."

"Of course not, Mr. Smith. That's why it's good psychology to drag the set out and work on it where they can't see you."

"Yeah? That's crooked business."

"No, it isn't. It's just letting them take for granted the fact that it takes brains to fix a set and that it costs you money to go and come, rather than trying to explain it to them every time. No use trying to reason with people when they're paying out money. If she had paid it this time she would have said 'Never again' and would have coughed up five dollars to your competitor next time without a whimper because he had to take the set down to his shop and give it expert care."

"I gave it expert care, I guess. Right there in her own home."

"Sure you did. And you fixed it. But you let her think that anybody could do it with a screw driver and a monkey wrench. People can't tell one service man from another, but they can tell one car from another or a fine shop with a lot of burnt-out meters stuck up in front from your little test kit that looks like a plumber's tool box. You have to use psychology."

"Maybe Mrs. Applegate has repented," remarked the smithy, as the phone rang again.

"Oh, good morning, Mrs. Adams."

"You say the radio doesn't sound as good as it used to? It was perfect when I left it."

"No, that little red thing was the same kind of resistor as the one I took out."

"Yes, I connected the wires back all right. The set's as good as it was when it was new."

"Well, I'll come out and listen to it, but I'm sure you're mistaken about its quality.'

"Well, goodbye, Mrs. Adams. I'll be out at two thirty."

"Get a lot of 'em like that," grumbled Mr. Smith, as he made a note of the time in his call book. "Especially old ladies. Once they see the guts of their beloved radio sets out in the open they are sure they will never be the same. Same type that is always sure the doctor sewed up a pair of scissors in some friend's tummy."

"Yes, it's a shame to let 'em see the innards. They might faint, or otherwise embarrass themselves." Mr. Johnson was developing a new clue.

"Sure causes me a lot of wasted time and gas," the smithy moaned.

"Might be a good idea to ask 'em to leave the room, or perhaps drag the set down to the shop—oh, that's right, you don't bother with that business, do you?"

"I been telling you there's too much overhead, ain't I?"

"Sure, I don't blame you for not wanting to shoot in all your profits on a shop and a gas buggy. Of course these return trips give the old ladies a lot of satisfaction—"

"Dadblame the old ladies and their satisfaction. Now who's this? Let's see if one out of three phone calls can be a new job." Mr. Smith was beginning to grow impatient.

"Mr. Harrison? Oh, yes. Radio giving you trouble again?"

"How do you know it isn't in the power pack this time?"

"You've got it all to pieces? Parts all over the kitchen? My gosh, Mr. Harrison! Now how'm I to know what came from where?"

"Well, I'll come out and take a look at the remains. Say about four o'clock. Goodbye."

"Talk about your old women! This old codger thought because he saw me take his set apart last time that he could do it himself and now he has parts all over the kitchen. Good gosh, what a mess!"

"Maybe if you give him a couple more lessons—"

"Oh, shut up! Say, what'll you give me for old Henrietta out there, and how much a month on this delivery job?"

Circuit Analysis of the BRUNSWICK

Models 15, 22, 32 and 42

THESE Brunswick receivers are comprised of three r-f stages in which screen grid tubes are used, a screen grid detector and a pair of '45s in parallel. An '80 is used as a rectifier.

The antenna is inductively coupled to the first grid circuit, a local-distance switch disconnecting the input circuit from the antenna, except for the capacity leakage through the switch itself, and shunting a .0002 μf condenser around the coupling coil and a small r-f choke in series with it.

Each r-f grid is grounded, after having passed through the grid coil. Each plate is coupled to the succeeding grid through a very small capacitance, being supplied with d-c through an r-f choke. The capacitance that couples the first plate to the second grid circuit is variable and has a small section which allows some of the r-f current to go to ground. This is a very simple way of controlling the volume of the receiver without affecting the operation of any tube.

The three r-f cathodes are joined together and connected to ground via a 300-ohm resistor, which drops 2.58 volts for grid bias. Incidentally, the method used in drawing this circuit is worthy of much commendation and appreciation from those who would grasp the significance of each and every component. It is absolutely self-explanatory—but this page must be written. The plates are supplied with their d-c from the low potential end of the a-f choke in the filter, through a 180,000-ohm resistor which drops 186 volts, leaving 180 for the plates. This line further supplies the screen grids, dropping 105 volts through the 35,000-ohm resistor. The 50,000-ohm resistor between the screen grid line and ground serves to stabilize the voltage. The detector screen grid is fed from the same source of supply, another 180,000-ohm resistor being connected in series and a 250,000-ohm resistor acting as a bleeder. All of these resistors, of course, are by-passed and serve as r-f filters as well as voltage reducers.

The detector grid circuit is similar to the others except that a .02 μf condenser is in series with the tuning condenser and the former is shunted with a 4-meg-ohm resistor. A 25,000-ohm resistor supplies the voltage drop for grid bias.

Resistance coupling is used between the detector and a-f amplifier. The detector plate feeds into a two pi filter section, plate voltage being supplied from the high voltage line after it has passed through the speaker field winding, a 50,000-ohm resistor and the 250,000-ohm coupling resistor. A .02 μf condenser couples the detector plate and a-f grids, and a 500,000-ohm resistor forms the secondary of the a-f coupling unit. The power tube plates are fed into the output transformer through a 1 μf condenser.

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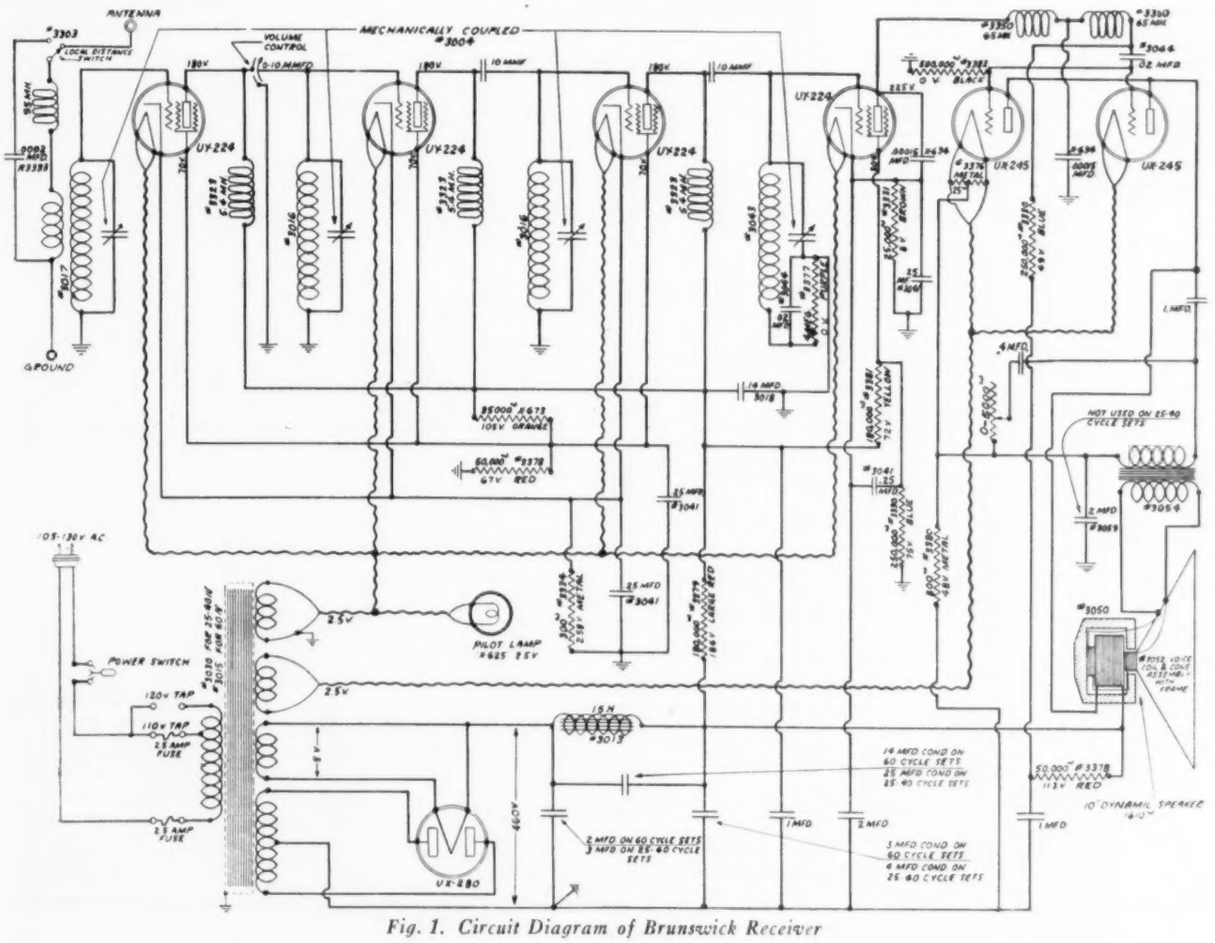


Fig. 1. Circuit Diagram of Brunswick Receiver

Models 60 and 61

Circuit Analysis of the BOSCH

THESE receivers have three screen-grid r-f stages, a screen-grid detector, a resistance coupled a-f stage with a '27 and a push-pull power stage with two '45s. An '80 is used for a rectifier and another '24 screen-grid tube is used as an automatic volume control. Five tuned circuits are employed, one of them being a pre-selector circuit ahead of the first grid circuit, another being coupled inductively to the plate circuit of the second tube and the other three in the grid circuits of the first and third r-f tubes and the detector. The second r-f grid is untuned.

The local-distance switch couples the pre-selector circuit to the antenna for distance reception and to ground, through a 500-ohm resistor, for local use. The antenna trimmer condenser setting seems to be very constant over the whole frequency band.

The plates of the first two r-f stages are supplied with the full output of the filter. The screen-grids are fed through a 20,000-ohm resistor from a point in a voltage divider that shunts the speaker field winding. The first grid is connected to the second through a 1000-ohm resistor, and the two of them are joined to a point in another voltage divider through two .5 megohm resistors. This point is negative with respect to the end of the divider to which the first two cathodes are connected, giving the r-f grids their normal bias. The elements of the automatic volume control tube are also connected to various points in this voltage divider, the grid going to ground or the negative end through the secondary of the detector r-f transformer, the phono switch and the detector grid bias resistor. The plate goes through one of the .5 megohm resistors in the r-f cathode lead. Therefore, when greater signal current is put onto the detector grid and the automatic volume control grid in parallel with it the plate current of the latter increases, causing a voltage drop in the .5 megohm resistor with a subsequent rise in grid bias for the first two r-f tubes. This, of course, decreases the volume automatically. The meter in the cathode circuit gives a reading of the r-f plate current, showing a peak at resonance which cannot be perceived by the ear, due to the fact that the volume is the same over several kilocycles. This volume control system takes hold at a very low input and operates very accurately.

Two tuned circuits separate the second r-f tube from the third. The grid bias for the third stage is obtained from the 1000-ohm resistor. Two phonograph switches are thrown by the gang condenser shaft; one shorting the third r-f grid direct to ground and the other throwing in the phonograph pickup. The third r-f plate receives its voltage from the low potential end of the speaker field winding, which serves as the second a-f choke.

The detector grid bias is supplied from a 50,000-ohm resistor between cathode and ground, the screen-grid voltage from the same source as the automatic volume control tube and the plate voltage from the line that supplies the third r-f plate. This voltage passes through the .5 megohm coupling resistor. While the r-f component in the detector output circuit is filtered out of the a-f circuit it is not kept from the power supply, although a .5 μf by-pass condenser is supplied for this purpose. The path of lowest resistance, in other words, is not through the by-pass condenser but direct to the power supply. Ordinarily the r-f filter would be connected between the plate and the plate resistor.

The .5 megohm grid coupling resistor is variable, serving as the manual volume control. The 160-ohm resistor section of the third voltage divider, the one between the '45 filament center tap and the positive lead, supplies the bias for the first a-f grid. The plates of the two power tubes are fed from the junction between the choke and the speaker field winding, grid bias being supplied by the drop through the 950-ohm resistor on the low potential end of one of the voltage dividers, connected between ground and the center tap of the filament shunt resistor. A tone control is connected across the two '45 grids, and consists of a variable .5 megohm resistor and a .006 μf condenser.

(Performance Curves on Page xiii)

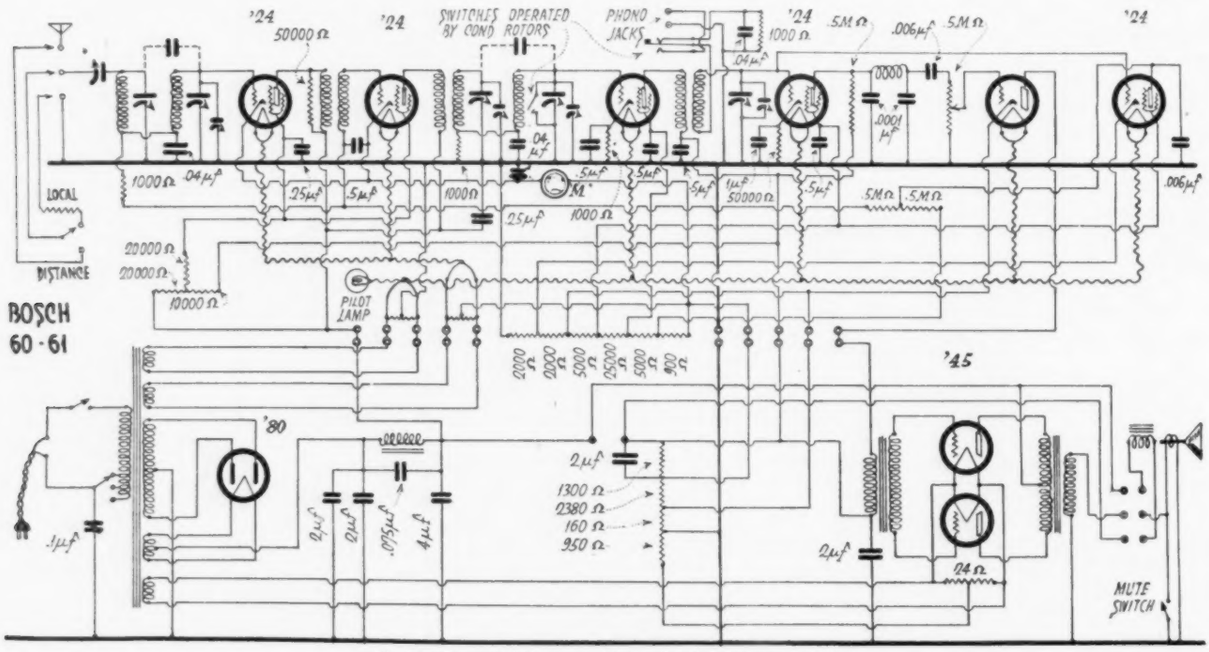


Fig. 1. Circuit Diagram of Bosch Models 60 and 61

Circuit Analysis of the PHILCO

Models 96 and 96-A

THE Philco receiver employs three '24s in the r-f stages, a '27 detector with a detector-amplifier of the same type, a '27 first a-f tube and a pair of '45s in push-pull for the power stage. The rectifier is an '80. The antenna circuit is untuned, and coupled to a tuned circuit which precedes the grid circuit of the first tube. This is sort of a preselector arrangement, giving four tuned circuits instead of three, and thereby increasing the selectivity noticeably.

The three r-f cathodes are grounded, while the grid of the first tube is connected to the grid of the second through a 70,000-ohm resistor, and the two of them pass through a 500,000-ohm resistor to the junction between the grid of the detector amplifier and the 250,000-ohm resistor which separates the latter from the grid and plate of the detector. These two elements of the detector are tied together, allowing the tube to act as a two-element linear detector. The third r-f grid goes to the detector grid and plate also, but through another path; *i. e.*, through a separate 500,000-ohm condenser and the upper of the two 100,000-ohm resistors between detector grid and cathode.

The a-f component of the detector output is small, therefore it is amplified by the detector-amplifier tube, which might just as well be called the first stage of a three-stage amplifier. The d-c component is large enough to control the bias on the r-f grids, hence the volume. When no signal voltage is passing through the r-f circuit a constant bias of 3 volts is applied to the grids of these tubes. When a signal is tuned in and amplified by the r-f stages the d-c output of the detector adds to the grid bias, blocking the passage of too greatly increased signal voltages.

The plates of the three r-f tubes as that which supplies the plate of the detector-amplifier; from the low potential end of the speaker field winding. The screen-grids are also fed from this line after a part of the voltage has been dropped through a 13,000-ohm resistor. The 70,000-ohm resistor which connects this point to ground is used as a bleeder for the stabilization of both the plate and screen-grid voltages. A 1 μf condenser by-passes this bleeder resistor. Two separate resistance-capacitance filters are employed in both the r-f plate supply line and the screen-grid supply line, one filter being connected between the first and second tubes in each line and the other between the third tube and the power supply.

The output of the detector-amplifier is filtered of its r-f component through a .00025 μf condenser between plate and ground. Then it is coupled to the grid of the first a-f tube by the usual resistance-capacitance method, the plate resistor being divided between the 250,000-ohm section and the 500,000-ohm section and by-passed to ground at the junction. The same thing is true of the grid resistors, the filter condenser, in this case, being one of those in the main condenser block. The resistor closest to the grid has a variable potentiometer arm and is used as a manual volume control.

A tone control is supplied in the output circuit of the first audio tube, and acts to by-pass the high-frequencies at varying rates according to the amount of capacity across the plate and ground. The cathode is grounded and the grid return leads to the center tap of the high voltage secondary. As this point is separated from ground by two 70-ohm resistors the bias is supplied to the grid from the voltage drop through the latter. The plate of this tube, after going through the primary of the a-f transformer, passes through a 25,000-ohm resistor, which reduces the plate voltage to the required amount, to the low potential end of the speaker field winding.

The grids of the two '45s are biased by the drop in the 800-ohm resistor between the filament center-tap and the negative high voltage lead. The plates are supplied, through the two sections of the output transformer secondary, from the high potential end of the speaker field winding. The output of the '80 rectifier is filtered through an a-f choke, which, with a 3 μf condenser on each side, forms a single filter circuit. This choke is shunted with a .3 μf condenser which has the effect of tuning the LC circuit to the greatest possible reactance at 120 cycles.

(Performance Curves on Page xii)

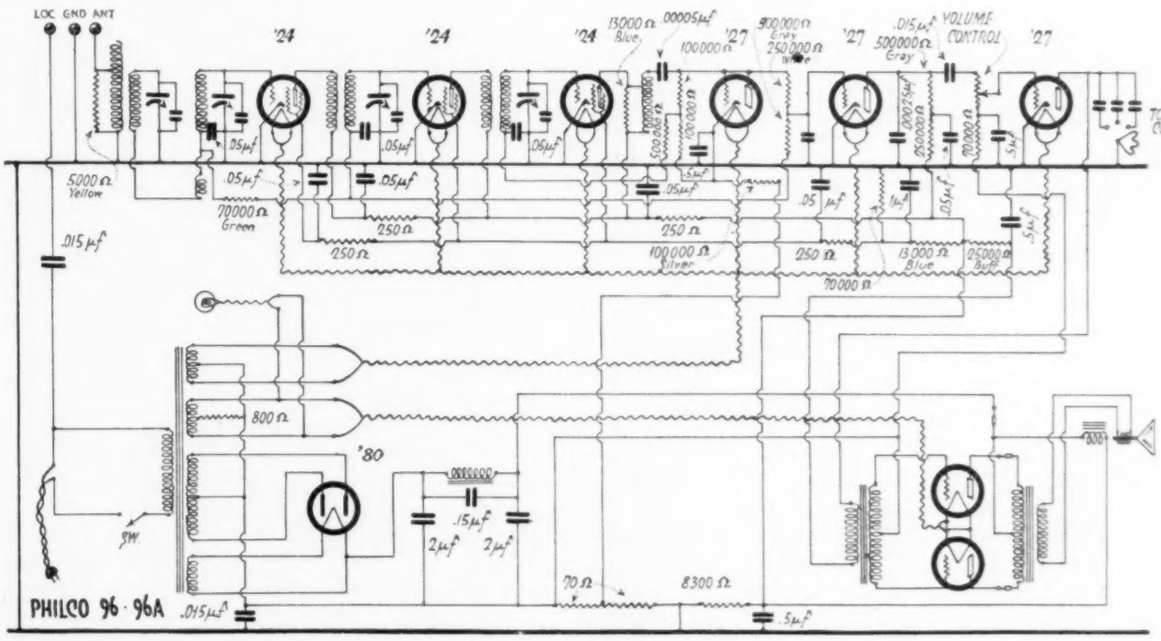


Fig. 1. Philco Circuit Diagram

Circuit Analysis of the

Model 230-A

MAJESTIC

Screen Grid Receiver

THE Majestic screen grid receiver has three r-f stages in which G-24 tubes are used, a screen grid detector and a pair of G-45s are employed. A G-80 is used for the rectifier.

The local-distance switch shorts across the ground and antenna posts for local reception. The antenna is coupled to the first of the two tuned circuits which precede the first r-f stage through a small compensating condenser. The two circuits are magnetically coupled and connected to ground through a by-passed 500-ohm resistor. The circuit following the first tube is untuned, and designed for greatest gain, while the second tube is followed by another double tuned circuit similar to the first except that it is inductively coupled to the preceding plate circuit. The third r-f tube is coupled to the tuned grid circuit of the detector inductively also.

The first two r-f cathodes go to the movable arm in the 1260-ohm volume control resistor which is a section of the voltage divider, while the cathode of the third r-f tube goes direct to the negative end of this resistor. The screen grids are fed from the junction in the divider between the 7900-ohm unit and that of 3340 ohms, that for the third tube being reduced slightly through a 500-ohm resistor. The r-f plates are supplied from the terminal between the 5230 and 4875 ohm units, and again a slight reduction is made for the third plate.

The phonograph switch in the detector circuit is interesting. When thrown to the right for radio reception the screen grid voltage for the r-f tubes is applied, the detector bias is taken from the drop through a 35,000-ohm resistor between the cathode, switch and ground, and the grid return is grounded. When thrown to the left for phonograph reproduction the r-f screen grid voltage is grounded through an artificial load, the detector grid bias is obtained from the drop through another resistor, 7900 ohms, and the grid return is connected to the output of the phonograph pickup.

The output of the detector is filtered through one pi filter section and passed to the primary of the audio transformer. A 1-megohm resistor in series with a .002 μf condenser across the detector plate and cathode serves to knock off a few of the high frequencies. The detector plate is fed from the output of the third a-f choke, the voltage being of the order of 263 volts. The screen grid goes direct to a point in the voltage divider between the 3340 and 5230 ohm units.

The power tube grids are grounded, through their respective secondary sections, grid bias for these tubes being supplied by the drop of the 800-ohm resistor between the filament center-tap and ground. The plates are fed from the output of the second choke. The speaker field winding is shunted across the voltage divider.

The power supply transformer is tapped in the primary for voltage adjustment. Four secondaries are provided; one for the r-f and detector heaters, one for the high voltage, one for the rectifier filament and one for the filaments of the two '45 tubes. Three audio frequency chokes are used in the filter circuit, the first two being of low inductance and the third somewhat higher. The three filter condensers are of 2 μf each, although for 25 cycles the first filter condenser is of 4 μf capacity, the second is the same and the third has a capacity of 2 μf.

The phonograph pick-up is connected across the primary of a transformer, the secondary of which is shunted with a .007 μf condenser and a 500,000-ohm volume control potentiometer. This resistor is mounted on the same shaft as the volume control resistor of the radio receiver, eliminating the necessity for more than one knob. As the section of resistance between the movable arm, or the grid of the detector, and the grounded end of the potentiometer is increased the volume is increased.

(Performance Curves on Page xii)

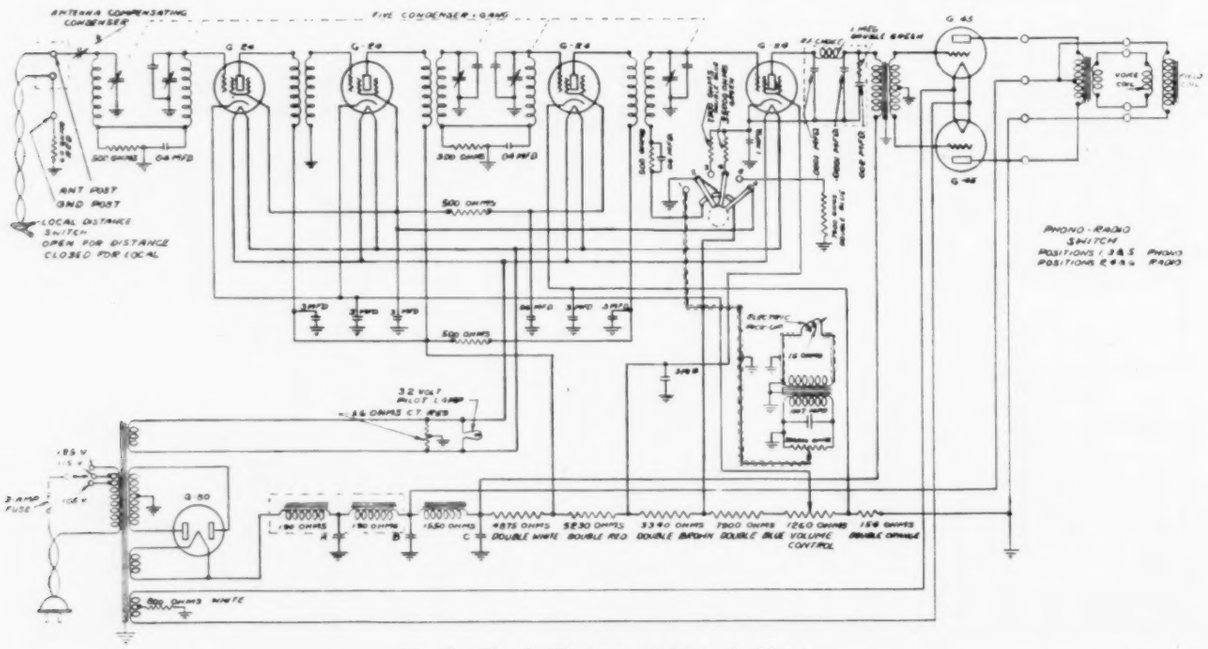


Fig. 1. Circuit Diagram of Majestic 230-A

? s That *Service Men* Are Likely to Meet in *Forthcoming Examinations*

By J. EDWARD JONES
President, Pacific Radio Service Managers' Association

Q. What is the maximum allowable peak grid swing of a power tube?

A. The peak grid swing must never exceed the grid bias, or the grid will go positive and distortion will result.

Q. What is the principal function of a shielded lead-in and ground system? Why?

A. The principal function is to limit all pick-up to the flat top of the antenna, because interfering disturbances are greatest at ground level, while space a few feet above roof is usually clear. Lead-ins usually pass down or through buildings paralleling a multiplicity of radiating metallic surfaces and circuits. Shielding the lead-in effectively removes interference from these sources, but care should be taken to ground the shield at several places to the water pipe system to which practically all other wiring systems are grounded, with the set itself to an independent ground.

Q. Given a radio frequency transformer tuned by a given condenser to cover the broadcast band, at what part of the band does the greatest transfer of energy from plate to grid circuit take place?

A. At the high frequency (low wavelength) end because the mutual inductance increases with increase of frequency between circuits magnetically coupled.

Q. What would be the apparent effect of a shorted filter choke?

A. All voltages would be generally higher, the amount depending on the normal drop in the choke now removed. Also reproduction would be accompanied by excessive hum tending to modulate music and voice.

Q. In an audio frequency transformer, as the turn ratio between primary and secondary windings governs the voltage step-up, why is it that very high ratio transformers are not used?

A. For code work, where one single note of approximately 400 cycles per second is used, transformers as high as 1 to 12 ratio are sometimes used, but in broadcast work where the audio frequency range extends at least from 100 to 3000 cycles per second, it is desirable to amplify these frequencies at about the same proportion or poor quality of reproduction will result. It is extremely difficult to design a transformer having both a high gain and a flat characteristic over such a wide band.

Q. Which of the following combinations will give the greatest resultant capacity when connected in series? First, two condensers, each having .0005 μf capacity; second, two condensers, one having .0006 and one having .0004 μf capacity. Also the combinations in parallel. Show figures.

A. Condensers in series: The reciprocal equals the sum of the reciprocals, or $\frac{1}{C} = \frac{1}{C_1} + \frac{1}{C_2}$ therefore $C = \frac{1}{\frac{1}{C_1} + \frac{1}{C_2}} = \frac{C_1 \times C_2}{C_1 + C_2}$

Using formula; first combination, $C = \frac{.0005 \times .0005}{.0005 + .0005} = \frac{.00000025}{.001} = .00025$. Second combination, $C = \frac{.0006 \times .0004}{.0006 + .0004} = \frac{.00000024}{.001} = .00024$. The first combination is largest by .00001 μf. Parallel: $C = C_1 + C_2$, 1st, $C = .0005 + .0005 = .001$; 2nd, $C = .0006 + .0004 = .001$. Therefore they are the same when connected in parallel.

Q. What is the approximate capacity between plate and grid in a '27 type tube, and to what extent has it been reduced in the '24 screen grid type?

A. The '27 type has a grid-plate capacity of approximately 3.3 μμf while in the '24 it has been reduced to .01 μμf. In other words, the '27 grid-plate capacity is 330 times greater than that of the '24.

Q. What is the usual proportion between the plate current and the screen-grid current of a '24 type tube?

A. The screen current should never exceed one-third the value of the plate current.

Q. What method of volume is used on the Radiola 64?

A. This set uses two volume controls. One, called sensitivity control, is a 2000-ohm potentiometer connected between antenna and ground, the center tap going to the grid of the first r-f tube. The other is a manual control regulating the action of an automatic volume control tube. The action is briefly as follows: The grid of the volume control tube is connected to the grid of the second detector by means of a small condenser which puts a certain predetermined proportion of the signal energy on the grid of the volume tube. This varies the plate current of the volume control tube which is made to flow through a definite portion of the biasing resistor of the r-f and i-f tubes, thus the volume is kept constant. The manual control regulates the amount of variation of the bias, and therefore regulates the output to any desired level.

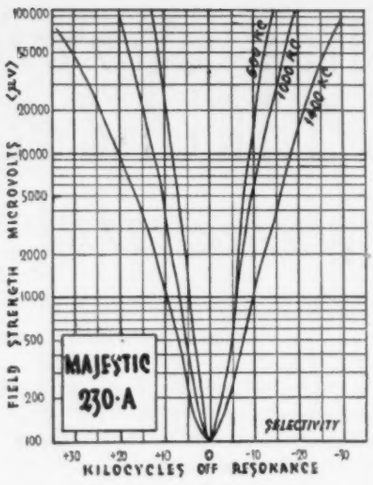
Q. What is the relationship between frequency and wavelength, and how do those used in broadcasting compare with visible light?

A. Frequency is the number of complete cycles taken by an alternating or oscillating current in one second. Wavelength is the distance from peak to peak of waves traveling through certain media. Radio waves travel through the so-called ether approximately at the rate of 300,000,000 meters per second, therefore speed is the true link or relationship between wavelength and frequency. The speed of light or electricity being fixed, if the wavelength is increased the frequency must be decreased, and vice versa, as shown in the following formula, where λ is the wavelength, V velocity and F frequency. $\lambda = \frac{V}{F}$ or, of course, $F = \frac{V}{\lambda}$.

In comparison, light waves are similar to radio waves, the only difference being that the frequency is many thousands of times greater, therefore the wavelength very much shorter for the same formula holds true for both.

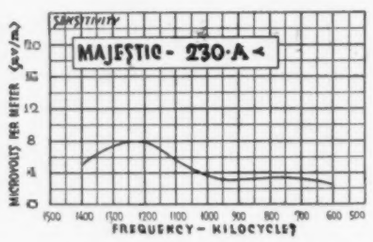
Q. What is meant by the term "per meter height of antenna"?

A. It is a term used in the measurement of the sensitivity of a receiver. Voltage from a passing ether wave is impressed upon an antenna according to the height of the antenna above ground and the strength of the wave. Antennas are of various heights, therefore measurements are reduced to a standard value, and for comparison's sake the number of microvolts for each meter height of antenna that will produce 50 milliwatts in the loudspeaker is taken as a standard of measurement.



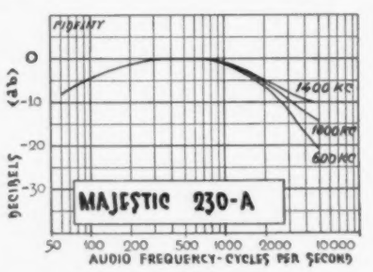
Majestic Selectivity Curves

THE selectivity of the Majestic Model 230-A is very good on all frequencies; a good deal better, in fact, than that of any Majestic model heretofore. The interference ratio, looking at the 1400 kc curve, is 460 to 1 at 30 kc off resonance, and 12 to 1 at 10 kc off resonance.



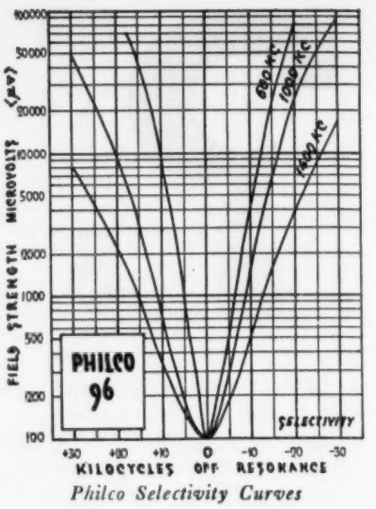
Majestic Sensitivity Curve

THE sensitivity of the Majestic screen grid model is well down into the small figures. While the curve touches five microvolts per meter at 1400 kc it takes a rise, hitting eight at 1200 kc, then drops down to three at 950 kc and even a little lower at 600 kc.



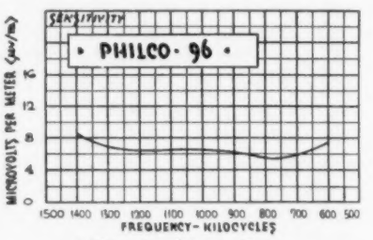
Majestic Fidelity Curves

THE fidelity of the Majestic screen grid receiver might be considered a little better than average. The low notes are dropped eight decibels at 60 cycles; i. e., the bass notes of this frequency are heard with eight sound units less volume than those notes of the middle register. The high frequencies begin to decline at six or seven hundred cycles, getting down to a ten decibel loss when the receiver is tuned to 1400 kc, a fifteen decibel loss at 1000 kc and a loss of about twenty-one decibels at 600 kc. Most of this attenuation is due to cutting of the sidebands, caused by the shape of the selectivity curve. This is necessary until the day when a selectivity curve can be horizontal for five kc each side of the resonance point, then take a vertical course the rest of the way. An attenuation of twenty-one decibels for the 5000 cycle tones is very good reproduction at the present stage of the art.



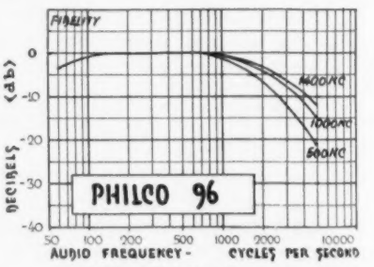
Philco Selectivity Curves

THE Philco 96 receiver is as selective as the usual receiver with four tuned circuits. At 1400 kc a 100 microvolt signal would have the same output as an 8000 microvolt signal on 1430 kc, while the interference ratio between the resonant signal and one at 10 kc away is but 3.3 to 1. The 600 kc curve, as is usually the case, shows much greater selectivity than those of the higher frequencies.



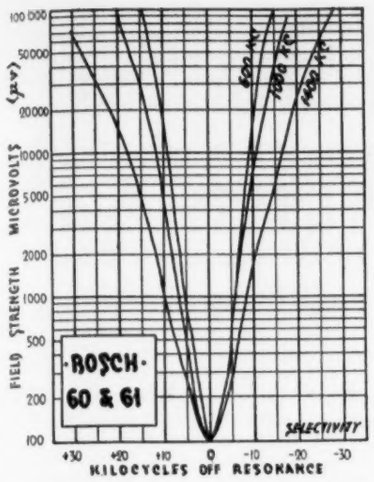
Philco Sensitivity Curve

THE sensitivity of the Philco receiver ranges from 8½ microvolts per meter to 5½ microvolts per meter, the most sensitive frequency being around 800 kc. While this may not be considered extreme sensitivity it is just about all that can be used, due to the fact that atmospheric and other electrical disturbances make reception pretty noisy under such conditions. The field strength of these disturbances can be measured, and has frequently been found to be of a value of more than 25 microvolts per meter, although ordinary winter time atmospherics and man-made "static" varies in strength from a fraction of one microvolt per meter to several hundred.



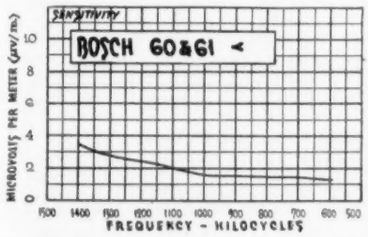
Philco Fidelity Curves

THE Philco fidelity curves show a very small attenuation of the bass notes, dropping, at 60 cycles, only 3½ decibels. At the high frequencies the 1400 kc curve drops 12½ db while that at 1000 kc goes down to 15 db and the 600 kc curve drops to 22 db at 5000 cycles. The reason that the 600 kc curve cuts off the highs more than the higher frequency curves is that the greater selectivity cuts off more of the sidebands.



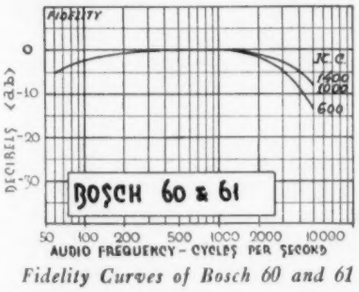
Selectivity Curves of Bosch 60 and 61

EACH year radio receivers get more selective. The improvement in this year's Bosch over last year's model is striking, especially along the lines of selectivity, although fidelity and sensitivity show great improvement also. The Sixty and Sixty-one 1400 kc selectivity curve is sharper by a good bit than the 600 kc curve of the Forty-eight of last year, whereas the 1400 kc curve of the latter passed over the thirty kc line on each side of the resonance point before getting out of the first quadrant. The 1400 kc curve of this model has a voltage ratio of a little over 700 to 1 when it crosses the thirty kc line, and 11 to 1 as it passes the ten kc line; meaning that it would take 700 times as much field strength from a station thirty kc off the receiver setting to effectively block the weak signal to which the set is tuned.



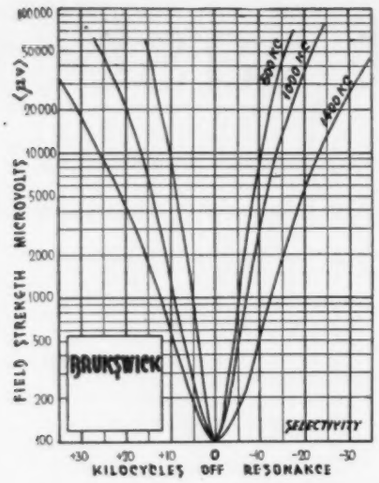
Sensitivity Curve of Bosch 60 and 61

THE Bosch's sensitivity curve is well down toward the bottom of the graph, touching three and one-half microvolts per meter at 1400 kc and increasing in sensitivity at the lower frequencies until it reaches one and one-quarter microvolts per meter at 600 kc. This means that the field strength required from a broadcast station to give average room volume is but from one and one-quarter to three and one-half microvolts per meter.



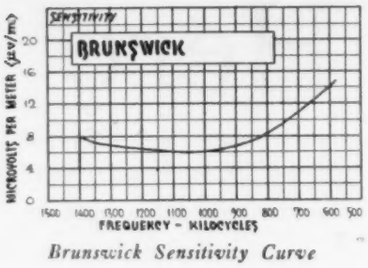
Fidelity Curves of Bosch 60 and 61

BOSCH fidelity is also something to brag about. The five-decibel drop at sixty cycles is average while the fourteen db attenuation at 5000 cycles is unusually low, indicating splendid high frequency reproduction.



Brunswick Selectivity Curves

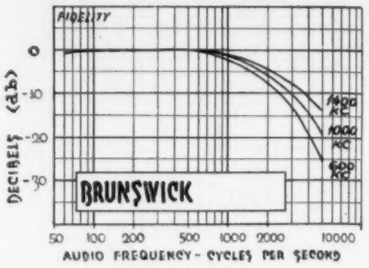
THE selectivity of the Brunswick receiver is a little better than average. At 1400 kc it would require a field strength of 17,000 microvolts to completely interfere with a 100 microvolt field strength. That is, if a distant station with a local field strength of 100 microvolts were tuned in on the dial 30 kc away from a local station, the field strength of that local station would have to be 17,000 microvolts in order to be heard with the same volume as the distant station. If it were half, or even a smaller fraction of 17,000 microvolts, it might still be heard in the background.



Brunswick Sensitivity Curve

BRUNSWICK sensitivity makes a shapely curve, reaching a maximum sensitivity of six microvolts per meter between 1000 and 1200 kc. It is slightly less sensitive at 1400 kc and drops to 14 microvolts per meter at 600 kc. This curve shows the amount of voltage needed in the antenna pick-up in order to obtain an output of 50 mw, the I. R. E. standard. This output is enough to give fair room volume.

THE reproduction of bass by the Brunswick receiver is unusually fine. At 60 cycles the curve shows the first inclination to drop, having held to a straight line up to 500 cycles per second. The deep bass notes, therefore, are to be heard with the same strength as those in the middle register. The highs drop gradually to values depending upon the radio frequency to which the receiver is tuned. At 600 kc the attenuation of 5000-cycle notes is but 26 db.



Brunswick Fidelity Curves

New Test Signal Generator

The General Radio Company has recently announced a Test-Signal Generator, Type 404, for the use of the service man. This is a portable instrument, designed especially for neutralizing and aligning radio receivers, but is equipped with an accurate attenuator so that, in conjunction with an output meter, quantitative sensitivity measurements may be made. These are especially valuable to the service man who is interested in checking up on the improvement resulting from changing tubes or making adjustments in the receiver. The output range of the instrument is roughly 10 to 1000 microvolts. The General Radio Type 486 Output Meter is an oxide rectifier type of voltmeter with the necessary voltage multipliers to give it ranges of 3, 15, 60 and 150 volts. It may be used for measuring the receiver output in connection with the Test Signal Generator, or for hum measurement, a-c filament and line voltages or for any audio frequency voltages.

A NEW TEST PANEL FOR THE SHOP

(Continued from Page v)

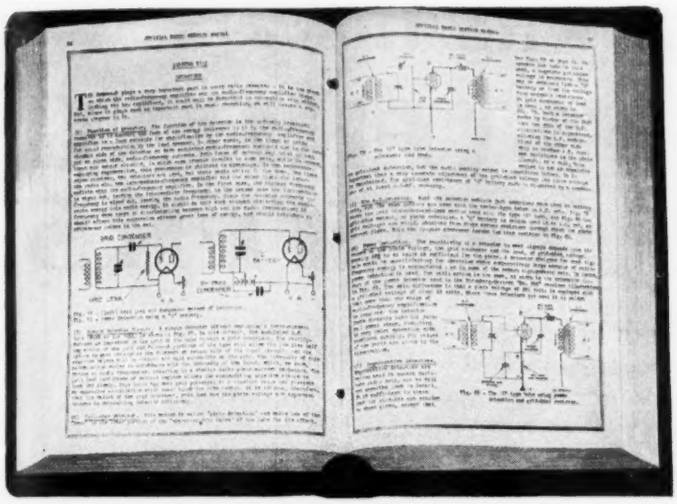
The eliminator load test requires but a few words of explanation. The output of an eliminator or powerpack is connected to terminals 21 and 22. Connections from 24 and 25 are plugged into one of the milliampere jacks and the Clarostat adjusted until a desired current is obtained. The plug is then removed from the meter and connections changed to 23 and 24 and now plugged into one of the voltage jacks. The reading will give voltage obtainable with output current previously determined and measured, and as volts times amperes equals watts, therefore the watt output is determined.

The power supply and filter needs little description. Many transformers with the desired windings are obtainable at various prices. Filter and bi-pass condensers can also be obtained of various makes and prices, or can be salvaged. The monitor speaker field may be used as the filter choke. For the voltage divider a 20,000-ohm Electrad, 6 inches long, with various bands for taps, is recommended. The amplifier may be constructed after any standard plan, good transformers of about a 3-to-1 ratio. Push-pull is not recommended, as it is not so flexible in testing various speakers. It is suggested that the power supply and amplifier be mounted on a metal sub-panel fastened to the rear of the front panel by brackets. All grounds should be connected to this sub-panel. It is also advisable to entirely shield the oscillator, also grounding the shielding.

While it is difficult to suggest the cost of the entire panel, due to many alternatives, all parts, entirely new and of reasonable quality, can be purchased for about $100 list, but, as we said in the beginning, many parts can be obtained from the junk drawer and obsolete sets. All in all it should cost a dealer about $60 net, exclusive of labor, tubes, speaker, turntable and pickup. The expenditure, however, is justified, for such equipment will facilitate sales, create sales and clinch sales. The oscillator feature alone can be made to pay for the entire equipment in one season, for every dealer has many customers on his books who would gladly pay for greater sensitivity, greater selectivity and greater radio satisfaction.

"Official
RADIO SERVICE MANUAL

and Complete Directory of all Commercial Wiring Diagrams



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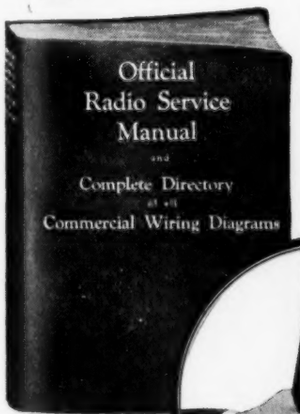

There has been collected for this manual wiring diagrams and data of nearly every commercial set, of which there is any available record, manufactured since 1927, and many earlier ones.

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Received my copy of the OFFICIAL RADIO SERVICE MANUAL this A.M. "She is what you call him: Magnifique! Exquisite!" A timely aid for the troubled sets. Thanks.—E. BOICE, 1118 W. Dauphin, Philadelphia, Pa.

FINEST THING

Just received the RADIO MANUAL. It sure is the finest thing I have seen.—E. J. SCHWARM, 465 Eddy Road, Cleveland, Ohio.

IT ASTOUNDED THEM

Everywhere I have exhibited the MANUAL it has taken the boys by surprise and its completeness has astounded them. For instance, Saturday morning last I had occasion to run into the service plant of the Mackenzie Radio Corp., New York District Distributers for Zenith Radio, in connection with replacement units, and when I showed the Service Manager, Mr. Wandelt, the MANUAL, he was agreeably surprised and called the men to see the work. Delightedly yours, and always a booster for Gernsback Publications, of which I read practically all, and study them.—IRA C. HALDERMAN, 44 Leroy Place, Ridgewood, N. J.

MAIL COUPON TODAY—

GERNSBACK PUBLICATIONS, Inc., SMS-10-30
96-98 Park Place, New York, N. Y.

As per your special offer, I enclose herewith $3.50 for which you are to send me postpaid, one copy of the OFFICIAL RADIO SERVICE MANUAL.

Name .....

Address .....

City..... State.....

When They Phone You... "*My Radio Set Won't Work*"

Your Service Man Can Make ANY Test With These

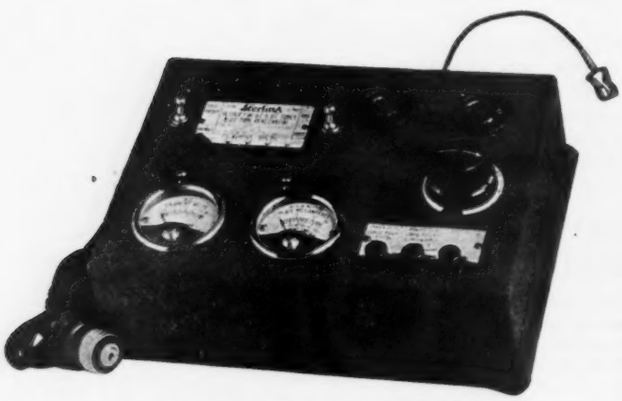
STERLING TESTERS

BE IN A POSITION to give the sort of service that makes friends and profits for your service department. Equipped with Sterling Testers, your service man goes out on the job, spots the trouble *instantly,* without fussing around; makes the necessary repairs and is back in your shop in half the usual time. One call—and you send out your bill to a satisfied customer. That's what Sterling Testers mean to you.

COUNTER TUBE TESTER

The Sterling R511 Tube Tester instantly shows the condition of every type of tube. Reactivates, too. It's small, good looking and never fails. No batteries. Simply plug it into the light socket to operate.

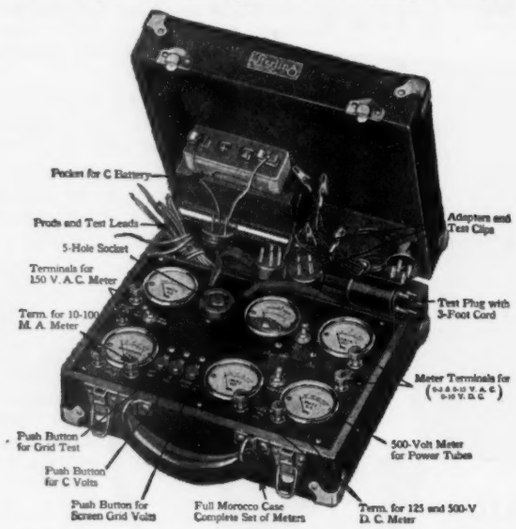
Write to Sterling of Cleveland for full information.



R511 TUBE TESTER
List Price $35.00

SERVICE TESTER

Sterling R522 All-Purpose Testers are neat, compact, efficient. In a handsome leather-grained case, weighing but 7½ pounds complete. Simply plug in the tube sockets of the set. Instantly the meters register the filament and plate voltage, "C" bias and milliampere drain, and definitely locate the trouble. Tests tubes, too—all types, including the new screen-grid tubes.



R522 ALL-PURPOSE TESTER
List Price $67.50

Sterling

THE STERLING MANUFACTURING COMPANY CLEVELAND, OHIO

MAKERS OF STERLING CONCERTONE RECEIVERS

RADIO

NOVEMBER 1930

IF COMPETITION

BOTHERS YOU STEP OUT IN FRONT OF IT

..WITH FADA

★ The New Fada 44—Sliding Door Lowboy, $188 without tubes

ONLY THE NEW FADAS HAVE
***ALL* THESE 14 FEATURES**

- ★ Noise Filter
- ★ Automatic Volume Control
- ★ Finer Tone
- ★ Flashograph
- ★ Beautiful Cabinets
- ★ Fada Dynamic Speaker
- ★ One Dial...One-Knob Tuning
- ★ Humless Operation
- ★ Phonograph Connection
- ★ Local Distance Switch
- ★ Pre-selector Tuning
- ★ Complete Shielding
- ★ Two-element Detector
- ★ Nine Tubes—including three screen grid.

★

OTHER NEW FADA MODELS

★ The New Fada 41—Highboy, $218 without tubes

★ The New Fada 47—Radio-Phonograph Combination, $328 without tubes

FADA Radio

Same Prices West of the Rockies, Slightly Higher in Canada and for Export

IF only one car had 4-wheel brakes, wouldn't you like to sell that car? If only one refrigerator made ice cubes, wouldn't you like to represent it?

That's about the situation between Fada and the field. While other radio manufacturers make advertising hullabaloo over a stray feature or two . . . a phonograph jack or even a dynamic speaker . . . Fada blazes out with fourteen.

To sell radio readily in today's market, you must have something to sell. Fada fairly sparkles with exclusive selling points. It puts on a unique demonstration, overwhelmingly convincing to both eye and ear. Fada furnishes ammunition that is an inspiration to salesmanship. No other radio has so many of the features that the consumer itches to own.

Step out of the profitless area of cluttered-up competition. Sell a radio that is out in front, all by itself . . . provably the most advanced radio of the year. Sell Fada. Wire or write for the clinching details.

F. A. D. ANDREA, INC., LONG ISLAND CITY, N. Y.

★ The New Fada 42 — Open Face Lowboy, $159 without tubes

★

★ The New Fada 46—Highboy, $228 without tubes

Fada Models 42, 44, 41 and 46 are also available for operation on 25 cycle or direct current (DC) at slight increase in price.

1920 · SINCE BROADCASTING BEGAN · 1930

The KENNEDY Coronet

List Price
$69.50
Complete

HERE is a miniature set that will operate in any locality where larger receivers will operate. The *Kennedy Coronet* is exceptionally sensitive and even in cities with a number of powerful broadcasting stations, it will pick up the station quickly and clearly without overlapping. It is equipped with a *Selec-tone Control* to tone reception to suit the individual preference.

Encased in a beautiful cabinet of butt walnut, the *Kennedy Coronet* has a strong "eye appeal" and its selectivity, power and tone quality will win the instant admiration of any of your customers desiring a miniature set.

Your request for information will be answered promptly and in detail.

SPECIFICATIONS

Height, 17 inches. Base width, 16½ inches. Depth, 10 inches. Weight (less shipping case) 31 pounds. Tubes, four No. 224 screen grid; one No. 245; one No. 280. Full size transformer. Electro-dynamic speaker. Selec-tone Control.

Send coupon today for complete information about the Kennedy Co-operative plan.

KENNEDY

A STUDEBAKER FAMILY PRODUCT

The Royalty of Radio

Since 1911

COLIN B. KENNEDY CORPORATION Dept. R11-30
South Bend, Indiana Date.....

Please send full information about your co-operative plan for dealers.

Firm Name.....

Individual.....

Address.....

City..... State.....

RADIO

Established 1917 Reg. U. S. Pat. Office

PUBLISHED ON THE FIRST OF EACH MONTH
AT 428-430 PACIFIC BLDG., SAN FRANCISCO, CALIF.

Subscription Price, $2.00 per year in U. S. and Canada. $3.00 in Foreign Countries.
Entered as second-class matter at Post Office at San Francisco, Calif.

CONTENTS
for November, 1930

A Suggestion to the Reader:

After reading this November number of RADIO give it to someone else in the trade who might be interested in it. Even if he is your competitor, remember that the safest competitor is an educated one. RADIO is teaching better sales and service methods. But if you want to keep this number yourself, send the name of the man whom you think it would help and the publishers will send him a free sample copy.

Retrospects and Prospects

ALTHOUGH the volume of radio sales for this year will be less than that for 1929, it will probably be equal to that for 1928. Part of this year's volume represents distress merchandise carried over from 1929 and part of it is due to the popularity of low-priced midgets.

But the margin of profit is smaller than in 1928 or 1929. The sale of holdover stocks usually represented a loss for someone and the sale of midgets a very narrow margin of profit. Some midget manufacturers figure the profit on each set in cents rather than in dollars, depending upon volume of production for aggregate profits.

The superheterodyne has recently introduced an indeterminate factor in the equations of radio sales. Its greater selectivity and sensitivity may force liquidation of some stocks of tuned radio frequency sets, relatively few in number because of early restrictions on production. Furthermore a hue and cry has been raised about the super "blooper" and unless convincingly disproved may cause some Golden Rule buyers to adhere to the tuned r-f sets which do not cause interference with neighboring reception.

After discounting all of the unfavorable factors which have tended to depress radio sales during 1930, the outlook for 1931 is distinctly encouraging. There is general agreement that general business will gradually improve during the year and with that improvement purse strings will be loosened for radio purchases. As yet there are only half as many radio sets as automobiles in use and only about half the 22 million wired homes are equipped with electric sets. Consequently the immediate market is only half saturated.

"RADIO," November, 1930. Vol. XII, No. 11. Published monthly by Pacific Radio Pub. Co., Pacific Bldg., San Francisco, Calif. $2.00 per year. 25 cents per copy. Entered as second-class matter at Post Office at San Francisco, Calif., under the Act of March 3, 1879.

Why Superheterodyne ?

THE ANSWER BY SILVER-MARSHALL

YEARS ago the important element in radio reception was sensitivity. Everyone wanted distance and lots of it. Then came the "tone period", when tone quality was all important. And now we are in the midst of the "selectivity era". But it has always been necessary to sacrifice something to attain the fad of the day. No receiver ever gave selectivity, sensitivity and tone quality, equally—until now. The new Silver-Marshall Superheterodyne sacrifices nothing! Hair-line selectivity, with 50,000 watt locals occupying no more than 10 kilocycles on the dial. Rich, natural tone. And the fact that Silver-Marshall Radios, manufactured during the night shifts in the Chicago factory, are tested on California stations, will give you an idea as to their extreme sensitivity. Nothing is sacrificed because the Silver-Marshall superheterodyne system subordinates nothing • The receiver boasts ten tuned circuits, five screen-grid tubes, two screen-grid detectors, and needs no aerial—all EXCLUSIVE with Silver-Marshall Superheterodyne Radio • And the dealers who sell them are backed by 99-Year Franchises!

SM **SILVER-MARSHALL**
RADIO

A sure cure for no-profit sales

The BLUE BOOK Convinces Without Argument

The Radio Dealers "Blue Book" has been compiled to give specific information sought by dealers everywhere. Through the cooperation of 5000 dealers, the value of trade-ins has been established. These values have been carefully checked by association secretaries, jobbers, and finance companies. They represent honest, impartial and fair prices, and are as accurate as the best thinking in the industry can make them.

The Blue Book is published four times a year. It is kept constantly up to date. Endorsed by 8300 dealers, 187 jobbers, 16 Radio trade associations. Price, $7.50 a year. Mail your order today.

THAT'S the gist of what dealers are saying about the Radio Dealers' Blue Book. It gives the last word in authoritative information on the trade-in value of every radio set built during the past eight years.

Blue Book data tells the dealer what allowance he can make and be safe. It tells the customer what he can legitimately expect on the set he trades in. It takes horse-trading with resulting headaches out of the radio business. It establishes good will. It builds safe, sane, sound business.

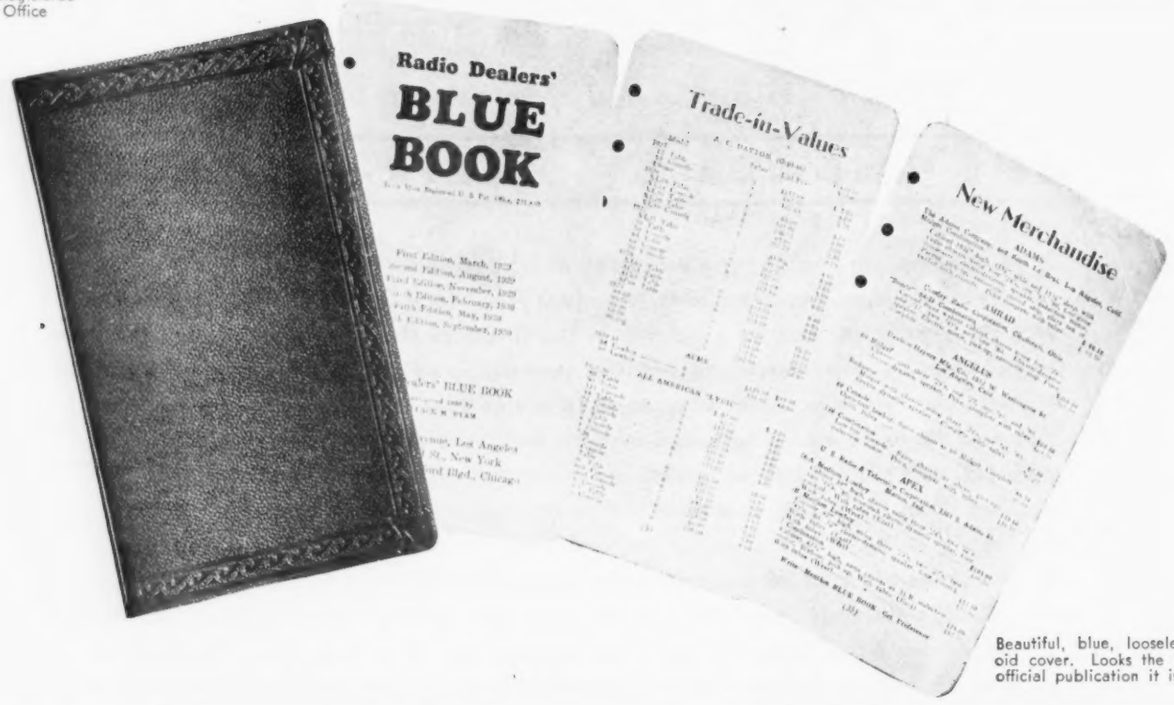
And it does more. It enables the dealer not only to make a profit on new merchandise, but also on the re-sale of the merchandise which he has taken in trade.

The Radio Dealers' "Blue Book" is a cure for no profit business.

ORDER YOUR COPY NOW!

Radio Dealers' BLUE BOOK

Trade Mark Registered
U. S. Patent Office
No. 231,480



Beautiful, blue, looseleaf leather oid cover. Looks the part of the official publication it is.

Pays for itself on the 1st trade-in deal!

Radio Dealers Blue Book (Send coupon to the nearest address below)
254 W. 31st Street, New York City.
Room 1100, Hartford Bldg., Chicago, Ill.
Publishing Office, 1220 Maple Ave., Los Angeles, Calif.
Please enter my order for a year's subscription to Blue Book. Price $7.50.

Name.....

Firm Name.....

Address.....

ORDER YOURS NOW

WHEN IT COMES TO CREATING CUSTOMER GOODWILL

NOTHING SUCCEEDS LIKE SERVICE!

Use *the* G-E Radio *Certified Inspection Plan*

THE national acceptance of products bearing the name General Electric has been built on two things—first class merchandise and customer satisfaction.

In the Radio bearing the G-E Monogram General Electric has provided the first essential.

In the Certified Inspection Plan General Electric ensures the second essential—customer satisfaction.

As a result the G-E Radio guarantee takes on added importance as a sales argument and as a builder of customer goodwill.

The Certified Inspection Plan brings you proof that you have gained the active goodwill of your customer.

It encourages your satisfied customers to recommend you and General Electric Radio to their friends.

Get full details of the Certified Inspection Plan—study it—and use it as a final and decisive sales argument.

SEND this Coupon NOW!

Section R-10211
General Electric Co., Merchandise Dept.,
Bridgeport, Conn.

Please tell me all about the G-E Certified Inspection Plan.

Name.....

Address.....

GENERAL ELECTRIC

FULL RANGE RADIO

GENERAL ELECTRIC COMPANY - MERCHANDISE DEPARTMENT - BRIDGEPORT, CONNECTICUT

WANTED: SAFE MEN for Dangerous Times

BUSINESS today needs, and needs desperately, executives with fresh minds and up-to-date equipment—men who are safe, not in the discarded sense of dodging decisions, but in the modern sense of *making* them and making them *right.*

During the next five very dangerous and exciting years, the new competition will make the fortunes of a lot of such men—and incidentally toss a lot of others on the scrap pile.

We are not in the least exaggerating this demand for trained executives. So badly are they needed that the key men of American business today have gone to extraordinary lengths in helping the Institute to train such executives. They have actually prepared for us a whole new Course, designed to meet the new conditions.

The authors of this new Course are men whose success belongs to the present—not the past. Their own success in the future depends in some degree upon their ability to find and develop capable assistants. That is why they have cooperated so enthusiastically with the Institute. Among them are:

Alfred P. Sloan, Jr., *President,* General Motors Corp.; Joseph P. Day, the real-estate wizard; Hon. Will H. Hays, *President,* Motion Picture Producers and Distributors of America, formerly U. S. Postmaster General; Bruce Barton, Chairman of the Board, Batten, Barton, Durstine & Osborn; John T. Madden, *Dean,* School of Commerce, Accounts and Finance, New York University; Dr. Julius Klein, *The Assistant Secretary,* U. S. Department of Commerce; George Baldwin, *Vice-President,* General Electric Company; Hubert T. Parson, *President,* F. W. Woolworth Company; David Sarnoff, *President,* Radio Corporation of America; F. Edson White, *President,* Armour & Company; and Dexter S. Kimball, *Dean,* College of Engineering, Cornell University.

In preparing the new Course and Service we have drawn, without regard to cost, on the time and interest of these outstanding business statesmen. It is new, challenging, utterly un-academic, vibrant with the energy of men whose names are magic in the councils of modern business. So new is it that the latter sections are not yet off the presses, although the work of assembling and editing is now complete.

We have prepared a new booklet which describes this new Course and Service. It is entitled "What an Executive Should Know." It is for men of serious purpose only. It will take about an hour to read, and it is free. Frankly, it is difficult for us to understand how any man who intends to make himself independent in the next five years can afford *not* to read it.

You *must* equip yourself to deal with what lies ahead. Send for your copy of this booklet today. It will come to you by mail, without obligation.

ALEXANDER HAMILTON INSTITUTE
392 Astor Place, New York City. (In Canada address Alexander Hamilton Institute, Ltd., C. P. R. Building, Toronto.)

Send me without obligation the new booklet,
"What an Executive Should Know"

Name_____
Business Address_____
Business Position_____
Type of Business_____

Out of this depression will emerge new fortunes, new leaders . . . *You*?

WHEN THEY HEAR THE DIFFERENCE AND SEE THE REASON, YOU'VE SOLD A SET OF TUBES! . . .

CUSTOMERS aren't always convinced by a meter-test of their tubes. But Eveready Raytheon Tubes invite a more conclusive and *profitable* test . . . the test of better reception. With Eveready Raytheons, the improvement is startling . . . customers can always *hear* the difference.

For many customers, hearing is believing. But others want to know why these tubes make new radios out of old. That's another Eveready Raytheon advantage, because you can see the reason . . . in their patented 4-*Pillar construction*, which safeguards the fragile tube elements and maintains their perfect alignment.

Thousands of new dealers, from coast to coast, are stocking full lines of 4-Pillar Tubes. Service men are engaged in a nation-wide house-to-house canvass of prospective tube customers. With Eveready Raytheons, they have found that home demonstrations *sell tubes.*

Customers are asking for Eveready Raytheon demonstrations . . . and buying these tubes in complete sets, instead of just one or two at a time.

Eveready Raytheons come in all types, and fit the sockets of every standard A. C. and battery-operated receiver in present use. Ask your jobber, or write us now for the names of jobbers near you.

* * *

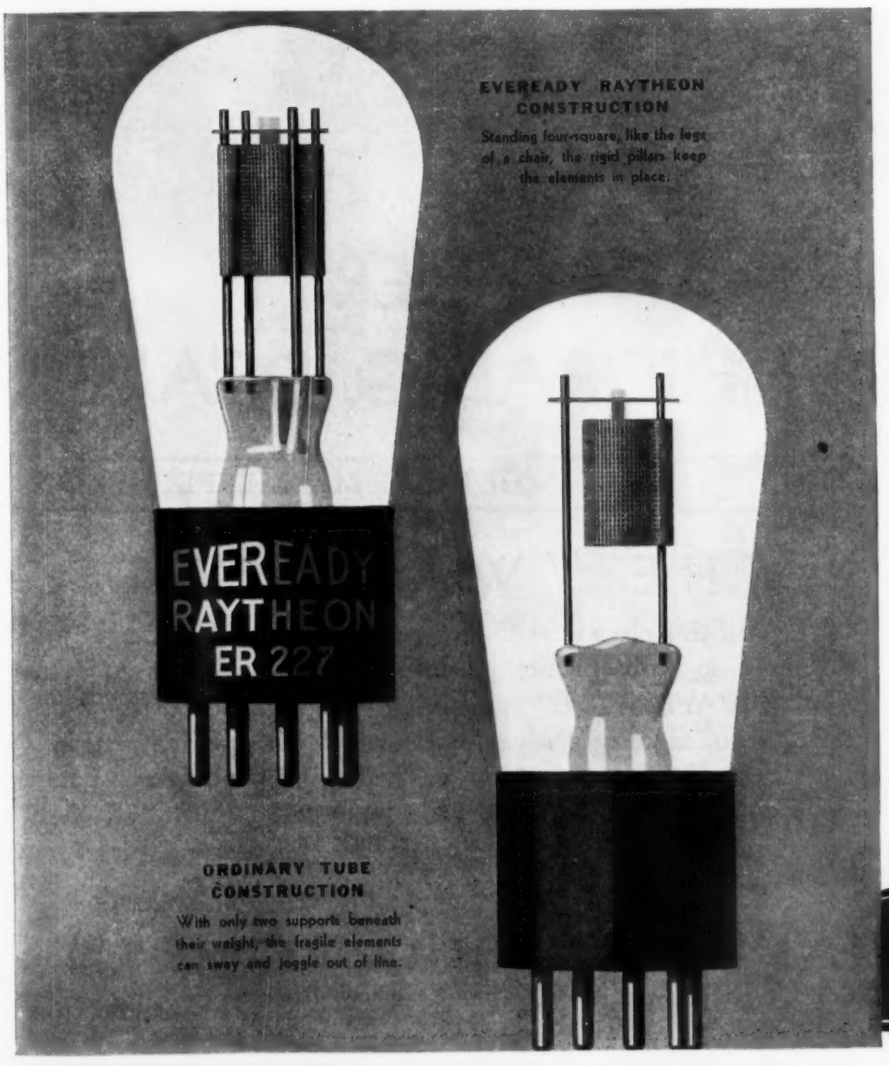
The Eveready Hour, radio's oldest commercial feature, is broadcast every Tuesday evening at nine (Eastern standard time) from WEAF over a nation-wide N. B. C. network of 27 stations.

NATIONAL CARBON COMPANY, INC.

General Offices: New York, N. Y.

Branches: Chicago Kansas City New York San Francisco

Unit of Union Carbide and Carbon Corporation



4 PILLAR TUBES

EVEREADY RAYTHEON

Trade-marks

A NEW PROFIT-MAKER FOR THE RADIO DEALER

THE LOWEST PRICED QUALITY ELECTRIC WAFFLE IRON

Order a Sample Today

Dealer's Net Price

$2.60 EACH

Six for $15.00

THE "WAFFLETTE"

Sell this electric waffle iron at your own list price. It will bring you profits during the holiday season. The "WAFFLETTE" is a practical 110-volt electric waffle iron, making a seven-inch waffle. It is heavily nickel-plated—has a six-foot cord with plug—and can be had with either green or black handles. A NICHROME element is used—guaranteed by the manufacturer for one year.

GENERAL MANUFACTURING COMPANY

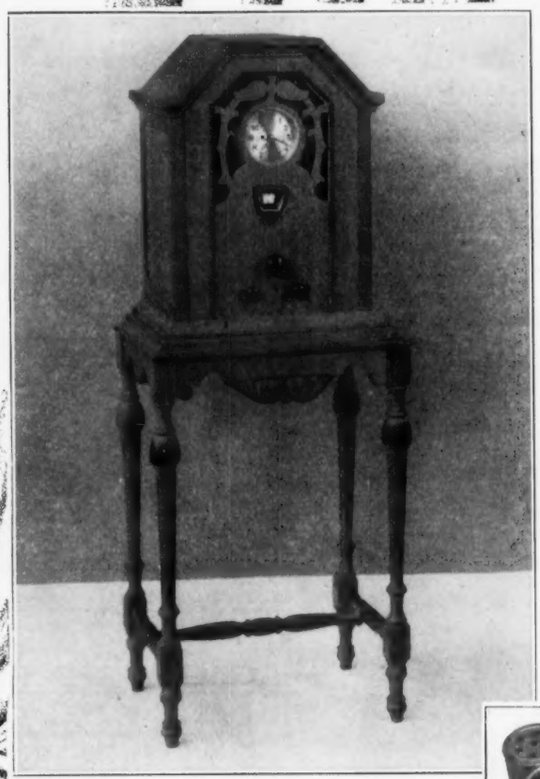
323 Sharon Building **San Francisco, California**

The HEADLINER of the SHOW

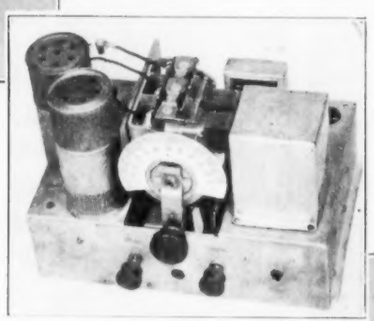
The *New* McCORMICK

Leader of

MIDGET RADIOS



DURING THE RECENT Chicago Radio Show, buyers everywhere acclaimed the McCormick as the ultimate in radio perfection. Triple screen grid operation—big set performance—exceptional selectivity and sensitivity—ample volume—tone control—power dynamic speaker—rich walnut cabinet—all is combined to make the McCormick the leader of midget radio sales. Height 41½", weight 32 lbs. Can be conveniently placed in space 18" x 16". Beautiful ELECTRIC CLOCK operates off same wire as radio—whether set is turned on or off. Controlled by current from local power station. An exclusive feature of AUTOMATIC TIME SWITCH turns radio on or off at any time by merely setting the clock. *Write for the McCormick proposition today*—and let this new radio sensation help make bigger profits for you!



Midget Chassis

Six tube, triple screen grid. High gain R.F. Litz bank wound coils. Fully shielded. No oscillation. Audio combination resistance and transformer coupled. Tone control. Illuminated dial, and other features.

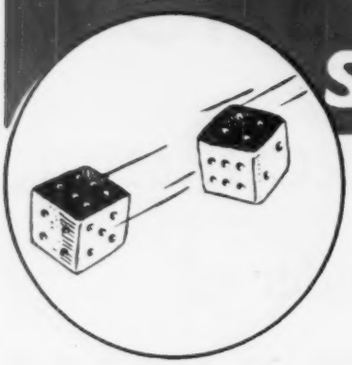
Mantel Model

This 6-tube midget—"just a little smaller"—is the same as the above console model, except for absence of legs, which can be added later if desired. Height 18½", width 14¼", length 10½", weight 25 lbs. An ideal set for any place where space is important!

McCORMICK RADIO CORPORATION

6932 North Clark Street **Chicago, Illinois**

Why GAMBLE speak for themselves



IN choosing your radio service instruments forget every claim and counter-claim—let the tests, the comparisons prove leadership. Each Supreme Instrument carries its own proof for its right to the title, "Supreme by Comparison"—the proofs of tests made by noteworthy technicians and which can promptly be affirmed by any service man who will make a comparison. Why gamble—let the records speak for themselves!

SET ANALYZING PLUS

In addition to providing for EVERY test reading afforded by ANY competitive commercial analyzer, Model 90 provides the following test ranges and features NOT embodied in any other analyzer, REGARDLESS OF PRICE:

D-C Plate Voltage ranges, 900/300/90/30/0.
Grid Voltage ranges, 300/90/30/9/3/0.
Positive and Negative Cathode ranges 300/90/30/9/3/0.
A-C 1000-ohms-per-volt ranges of 900/300/90/30/9/3/0.
Plate Current ranges 300/90/30/9/3/0.
Screen-Grid voltage ranges, 300/90/30/0.
Control Grid voltage ranges, 90/30/9/3/0.
Screen-Grid current ranges, 30/9/3/0.
Pentode (space charge) current ranges, 30/9/3/0.
Pentode (space charge) voltage ranges 90/30/9/3/0.
A-C readings in milliamperes; Meter ranges 300/90/30/9/3/0.

(In the foregoing only the ranges required in servicing present day sets are given, but for all voltage readings, scales of 900/300/90/30/9/3/0 are available and current ranges of 300/90/30/9/3/0, providing an elasticity that will meet any unusual situation and probably take care of all future radio developments.)

Output meter impedance ranges 11.1 to 900,000 ohms.

Universal Analyzer Plug for Pentode, Screen-Grid and Overhead (top) heater tube sockets.

Grid-to-plate analytical continuity tests.

High impedance measurements with 1000 ohms-per-volt A-C voltmeter.

Analytical A-C voltage 1000-ohms-per-volt tests up to 900 volts on each side of center-tapped plate supply transformers.

All connections from radio to analyzer for ALL tubes contained in one single cable.

Screen-Grid analysis without oscillation of circuits under test.

Uses ordinary flashlight battery for continuity and for "grid test" of tubes, the battery being normally connected to continuity pin jacks.

Twenty-two (22) meter ranges available at three (3) insulated pin jacks.

Provides a total of 119 distinct readings and ranges for analytical work compared with a maximum of from 25 to 30 in other instruments.

Every switch identified on the panel so clearly and simply that any radioman can make tests without previous instructions.

Meter withstands 5000 per cent overload.
Meter glass replaceable without meter removal.
No reversing switch necessary.
Measures power transformer secondary voltage directly from helium rectifier socket.
Screen-Grid tests without adapters.
Pentode Tests without adapters.
Maximum simplicity and speed.
Extremely rugged construction; maximum meter protection.

25 TESTING INSTRUMENTS IN 1

List Price . . . $112.15

Dealers' Net Price... $78.50

F. O. B. Greenwood, Miss.

A SET ANALYZER THAT OFFERS MAXIMUM SIMPLICITY AND SPEED WITH VASTLY GREATER NUMBER OF TESTS AND READINGS THAN CAN BE MADE ON ANY OTHER SET TESTER. ITS RANGE AND FLEXIBILITY WILL PROVE ASTOUNDING.

SUPREME
Set Analyzer
SUPREME BY COMPARISON

DO not buy any set tester without learning all about this marvelous instrument.

When you examine the marvelous meter employed in the Supreme Set Analyzer Model 90, you will understand the secret of this one meter set that gives more readings and ranges with a smaller number of switches, and with much greater ease and speed than any other commercial Set Analyzer. Such a wonder meter has never before been embodied in anything but the most costly laboratory equipment, but the ideal of "Supreme by Comparison" swept aside all consideration of cost in bringing out a Set Analyzer that would be worthy of Supreme traditions in the radio service world.

The panel to the left sums up some of its marvelous features, but you must see and experiment with it to fully appreciate its unapproached flexibility, minimum size and utter simplicity. Ask any user!

Conclusive evidence of its superiorities is shown in its choice by the R. C. A. Institutes—radio's oldest school—after exhaustive consideration of other outstanding analyzers. Why gamble when the records speak for themselves—"Supreme by Comparison."

when the records "SUPREME BY COMPARISON"?

SUPREME
Tube Checker
MODEL 19

COUNTER TYPE — List Price..... $38.50
Dealers' Net Price, F.O.B. Greenwood, Miss. $26.95

PORTABLE TYPE — List Price..... $42.79
Dealers' Net Price, F.O.B. Greenwood, Miss. $29.75

THE CHART TELLS THE STORY

THE chart below proves conclusively that Model 19 is the most reliable commercial tube testing instrument ever designed—make your own comparison to prove it. Challenge our statement that no other commercial testing instrument gives a comparable test on the screen-grid tube. No other Tube Checker can compare with it. Tests all tubes, including Pentode, Screen-Grid and the new 2-volt tubes without the aid of adapters. Astonishingly simple. On your counter, will step up tube sales.

COMPARISON OF MODEL 19 SUPREME TUBE CHECKER WITH TWO NEAREST COMPETITORS

TESTS	A	Supreme 19	B
Tests Overhead Filament Type tubes	X	X	X
Plate Current Reading	X	X	X
Grid Test on all Amplifiers		X	X
Pin Jacks Insulated	X	X	
Accurate Plate Current and Grid Test Limits on Panel		X	
Pentode Tube Tests		X	
All Tubes Tested with Rated Filament Potential		X	
2-Volt Tube Tests		X	
Tests both Plates, '80 Type Tubes without Adapters	X	X	
Screen-grid Operating Tests		X	
Available with Detachable Portable Cover		X	
Full size Transformer		X	
All Tube Circuits isolated from Power Supply Circuit		X	
Both Meter Scales Accurately Calibrated		X	X
All Tubes tested without Adapters	X	X	
Size of Meter	2-1/16"	3½"	3¼"

Comparison of construction, switches, parts, general appearance, design, etc., will establish like superiority.

SUPREME INSTRUMENTS CORPORATION
GREENWOOD, MISS.
Distributors in All Principal Cities
Service Depots in New York, Philadelphia, Pittsburgh, Chicago, Kansas City, Seattle, Toronto, San Francisco
Export Division: 130 West Forty-second Street, New York City
Cable Address: LOPREH, New York.

SUPREME
Radio Diagnometer
MODEL 400B

List Price, $199.29

Dealers' Net Price, F.O.B. Greenwood, Miss. $139.50

Has long been recognized as the most complete testing unit in the radio field. A most complete radio laboratory in compact, convenient, portable form. Thousands of unsolicited testimonials from technicians and practical service men attest to the enviable esteem in which it is held.

Provides oscillation test of tubes under radio frequency dynamic operating conditions.

Tests all types of tubes, including screen-grid, overhead heater types and the new 2-volt tubes. Tests both plates of 80 type full-wave rectifier tubes.

All tubes tested independent of radio.

Oscillator furnishes modulated signal for testing, synchronizing, neutralizing, etc.

Provides means for aligning of condensers by thermo-coupler meter.

Neutralizing of tubes actually used in set—only accurate method.

Tests gain of audio amplifiers.

Locates unbalanced power transformer secondaries.

Reads either positive or negative cathode bias.

Provides D-C continuity tests without batteries.

Indicates resistances without use of batteries in four ranges, .1 to 25. ohms; 10 to 200 ohms, 150 to 30,000 ohms (calibration curve furnished) 5,000 ohms to 5 megohms.

High resistance continuity for checking voltage, dividers, insulation leakages, bypass and filter condenser leakages, bias resistors, grid leaks, etc.

Low resistance continuity for checking rosin joints, shorted variable condensers (without disconnecting R-F Coil), Center tapped filament resistors, etc.

External connections to all apparatus.

Screen-grid and pentode socket analysis.

Measures capacity of condensers from .1 mfg. to 9. mfg.

Tests trickle charger by meter.

Bridges open stages of audio for testing.

Used in connection with Supreme Test Panel makes most complete laboratory equipment available, but still instantly available for portable use.

Special oscillator coil available as accessory calibrated to 175 and 180 kilocycles for peaking intermediate stages of Superheterodyne sets.

Take the first step to "Supreme" service and advantages by writing for descriptive folder, naming instrument interested in

for the finest performance – install a

WRIGHT-DE COSTER REPRODUCER

Radio manufacturers who are desirous of having their receivers operate with the utmost satisfaction for their customers, are frank in their approval of the WRIGHT-DE COSTER REPRODUCER. Such old established manufacturers of high quality receivers as Hammarlund-Roberts, Inc., and High Frequency Laboratories, have WRIGHT-DE COSTER SPEAKERS built to their specifications, and furnish them with their receivers to make sure of the very finest performance.

Above—Model 217 Jr. Chassis, suitable for installation in any radio receiver.

At left—Model 217-G, a beautiful cabinet and stand speaker for any receiver, or for use as a secondary speaker in another room.

Above—Model 207 Chassis, an exceptional speaker with great volume.

At right—Model 207-E, an attractive cabinet and stand that is a charming addition to any home.

You will appreciate the fine tone and great range of a WRIGHT-DE COSTER REPRODUCER in your set. No other will give you greater pleasure and satisfaction. Write for complete information and address of nearest sales office.

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Export Department: M. SIMONS & SON CO., 25 Warren St., New York. *Cable Address:* SIMONTRICE, NEW YORK

SELL RADIO LAMPS
for HOLIDAY PROFITS

RADIO LAMP
No. 742
85c Net
Six for $5.10
Complete with ground glass reflector, cord and plug. New Style Intermediate Base Socket. Globe 25c extra.

50% PROFIT FROM EACH SALE

SOLD TO YOU AT NET WHOLESALE PRICES
YOU MAKE YOUR OWN SELLING PRICE

RADIO LAMPS assure you of a profitable holiday season. They bring customers into your store. They sell themselves. They make beautiful window displays. They are attention-compelling. We suggest you give one with each radio set you sell.

Here is your opportunity to buy the finest radio lamps at net wholesale prices—sold direct from factory to you. Order an assortment of one each of six items shown on this page. Display them and WATCH THEM SELL THEMSELVES.

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With Ground Glass Reflector, Cord and Plug. $2.50 each, net
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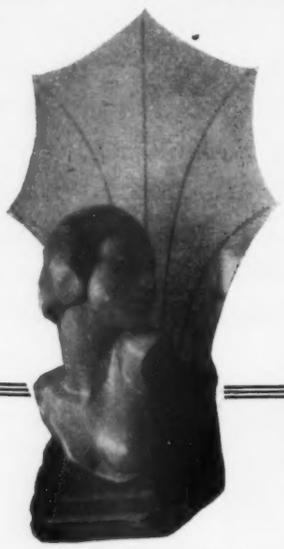
Intermediate base. Globe 25c additional.

NO. 744 RADIO LAMP
Complete with ground glass reflector, cord and plug.
$2.00 each, net. 6 for $12.00.
Uses Standard Base Globe



NO. 745 RADIO LAMP
Complete with ground glass reflector, cord and plug.
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$3.50 each, net. 6 for $21.00.
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C. O. D. shipments accepted if 50% of purchase price accompanies your order. Prices are F. O. B. Factory.

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Write or wire NOW

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MANUFACTURERS:

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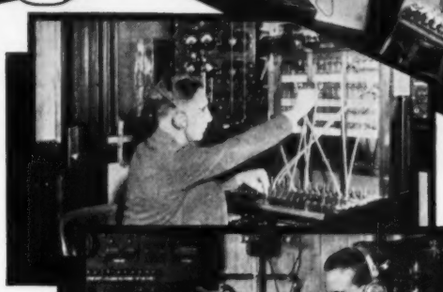

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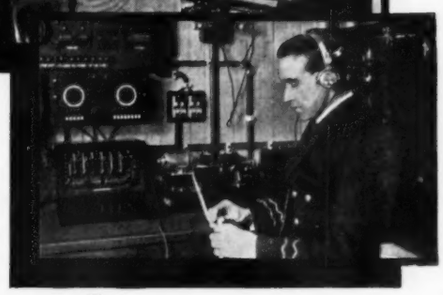

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Like a great wave piled up by the winds; irresistible in its growing power, and sweeping ever forward, the success of Brunswick is spreading across the land.

Dealers everywhere are discussing the importance of Brunswick among the first-rank leaders of the industry. They know that the tie-up with Warner Bros. Pictures has given Brunswick the opportunity to seize and hold this front-rank position. Brunswick is now more than a radio company — it is an operating unit in a great enterprise devoted to entertainment and Brunswick's part lies in the field of home entertainment.

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Brunswick Radio Corporation

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BRUNSWICK HIGHBOY MODEL 22:

Armored chassis, Circuit employing 4 screen grid tubes. Uni-Selector and Tone Control, 10-inch Dynamic Speaker. Walnut cabinet with French doors and curved corners ornamented with carved linen-fold design.

Price: less tubes **$170.00**

Other models $139.50 up.

BRUNSWICK RADIO FUTURA SERIES

RADIO

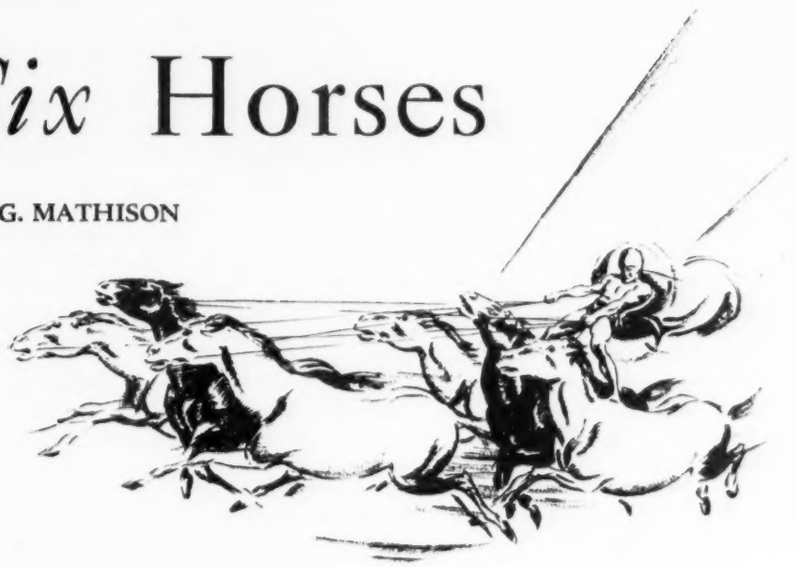
The National Trade Magazine

VOLUME XII NOVEMBER, 1930 No. 11

Riding *Six* Horses

By VOLNEY G. MATHISON

Should a dealer sell one or several makes of radio sets?



"BLAST IT!" fumed Gray under his breath; but outwardly he smiled upon Mr. Grouse, secretly dubbed "louse" by the office force of the Gray Radio Store.

"I want to be satisfied before I spend my money," whined Mr. Grouse. "I know you've had a Tin-Loaf, a Humming Lyre, an Imperator, a Junkola, and a Squarehead Olsen out for me to try during the last two months. They're all right, I guess, but my friend, Mr. Flapjaw, who lives next door to me, told me not to buy until I hear a Jillicricken Schlitz. It's the eventual thing in radio, he says. I'm not a crab, but—"

"Never heard of it, Mr. Grouse," said Gray, wearily. "I don't think it's a popular make. You've tried all the good ones I know of."

"But I want to be satisfied," repeated Mr. Grouse, in his thin nasal whine. "I don't buy a radio every day, and I want to be sure I'm getting what I want before I spend my money. If you can't do anything more for me, I'll be going. Sorry we can't do business. I'm not a crab, but—"

"Good-bye," said Gray, half sourly, half joyfully, and then he turned to his bookkeeper.

"How much are we out, demonstrating radio sets to that bird, I wonder?" he queried.

"I can tell you—about," replied the other. "He's had eight sets out there, and you know we figured long ago that it costs us an average of three bucks to make a demonstration, including haulage out and back—not to mention the slowed-up turnover from sets frozen that way. Then, too, he's cost our salesmen at least a dozen hours of time and several gallons of gasoline going out trying to close him. It seems to be hard to close a man when you once let him get to fidgetting among half a dozen sets."

"We're out about fifty dollars on him, then," said Gray.

"Nothing less," agreed the other.

"I'm not so sold on this idea of carrying a lot of different makes as I used to be," declared Gray. "We've got ten of the best on the market—and we made more money and had less grief when we sold just one good set."

AND that was a fact. The Gray Radio Company during its hectic career played both sides of the game—that of the one-set dealer and that of the all-set dealer; and herein are given some of the owner's experiences and conclusions about the two systems of selling radios.

It is rather obvious that the newer and smaller radio dealer is likely to start out selling one make of set for financial reasons. In order to go into the radio business, indeed, it is only necessary to buy one solitary set, sell that at a profit, if possible, and then buy another.

This was about the way the Gray Company came into existence. The concern was fortunate in getting franchised with the first big successful electric set, with dynamic speaker all built into one cabinet, ever to appear on the market. The Gray store rode upward swiftly on the popularity of that electric receiver.

The first two set were delivered early in June (1928). Thirteen sets were sold that month, all, of course, of that single make, which I shall here for convenience call the Imperator. In July thirty-five were sold; in August, seventy.

These sets were sold in two models, most of them retailing at $175, some at $213, plus from $10 to $20 carrying charges. The concern being a three-man layout at the time, close contact was maintained with the time-payment accounts and not many sets were repossessed. The gross profit for that month

of August was $5300, approximately. The final net—not including any salary to the owner—was actually in excess of $1500. By net profit I mean the profit after charging off not only overhead, but all repossessions, and otherwise eliminating everything that would tend to show the net profit more than it really was. This was accomplished with one make of set, and with a working stock of from ten to fifteen units.

In September another set was added—a very widely advertised make that had practically dominated the battery-set field. This set, which I shall refer to as the Tin-Loaf, was not taken on because the Gray Company was anxious to sell it, but because it was a set that prospective customers very often asked about and expressed a desire to hear in comparison with an Imperator. There was no comparison at all in our opinion, but it was easier to convince the customer of the fact by showing him than by arguing with him.

So we put in the Tin-Loaves. We did sell an occasional one or two of these, enough to keep the distributor of that make from getting suspicious. The thing was really so inferior to our Imperators that we closed sale after sale promptly after making a comparative demonstration in our little store. This practice, which is rather tough on the manufacturer of a mediocre set, is the gentle one known as "dynamiting."

Early in November the Tin-Loaf people came out with a more attractive machine, and it began to sell in spite of us, since it was cheaper than the Imperator. Its price complete was about $142 against $175 for the lowest-priced Imperator.

During December the Gray Company sold about ninety Tin-Loaves and eighty Imperators. Or rather we thought we had sold that many, as we had time-payment contracts on them.

Looking back now on the following ten months, however, I can see that this was a pipe dream. The cheaper set was sold to a less desirable type of customer and eventually we saw that almost all our Tin-Loaf contracts stood for weak accounts, while the Imperators represented relatively better ones. At any rate, by the time the last dog was dead the concern didn't make a dime on the Tin-Loaves.

Meanwhile other sets were being added. We did some effective advertising that Christmas season and other jobbers' salesmen came around begging to get their lines into the store. The Humming Lyre man left one of his machines for me to try out over night, but that same night I sold it and got thirty dollars down on it. Incidentally, and for a wonder, that customer kept his set and paid for it in full. That resulted in the putting on of the third line.

Having slipped into the practice of handling more than one set, it was hard to establish a rigid limit to the number of machines that would be carried. The profits obtained through the fall sales of straight Imperators were used, unwisely I now believe, to add line after line, until at last ten leading makes were advertised and kept on the floor. Besides that, two or three makes for which the concern had no franchise were carried for dynamiting purposes; that is, the sets were on hand for the customer to look at, but no attempt was made to sell them.

Now when the store carried one set and sold nothing else but that, it was possible to sell as high as seventy sets a month with a total working stock rarely in excess of ten unsold sets. These sets cost about $90 apiece; therefore the working capital in sets was less than a thousand dollars. In those days the outfit was making over a thousand dollars a month, there was always an ample bank balance on the ledger, and I used to be able to sleep soundly of a night.

Later, when the concern had developed into the all-set establishment, it was found necessary, in order to maintain unhampered demonstrations to prospective buyers, chronic set-testers, joy riders and other persons, to carry about eight sets of each make, except the original Imperator, of which about fifteen units were carried.

In order to keep the ratio of profit up to that which had been made the previous year with one set, it would have been necessary for the company to move from five hundred to six hundred sets a month. This, however, was never accomplished, the record being about 180.

Before, when handling one set, the deliveries and demonstrations were managed with one inexpensive truck driven by two boys. Carrying ten lines and giving prompt demonstrations, it was necessary to operate six trucks with six drivers and six helpers, together with two stockkeepers. The office force was increased from one to four, while the number of outside salesmen was practically unlimited.

The original floor space had become inadequate, the concern had had to move with an ultimate increase in rent from a thirty dollar a month location to two locations costing together $340 a month. The payroll—not considering any salary to the owner in either case—went from less than $350 a month to above $1400 a month. This also does not include commissions to salesmen.

When operating the smaller one-set layout, the owner was able to close 70 per cent of the customers, while with the ten-set establishment he had too much to do to close any, with the consequence that here was a new outgo amounting to from $1500 to $2000 a month that had not previously been a very large item.

Briefly, a tremendous business was done, but at a disproportionately increased expense. Indeed, the expense was so much greater than it had been in the little store that the final net profit earned would probably have figured out something like 15 or 20 per cent per annum on the $100,000 of capital in use. But, as has been fully dealt with in a previous article, when you use outside finance company money, it costs you from 17 to 30 per cent a year, and unless your final net profit is something far above that figure, you are going into the hole.

Selling 50 or 60 sets a month of one single make, the company cleared more than $1000 net a month on a working capital in sets, fixtures and equipment amounting to less than $3000. Selling ten makes and carrying a hundred sets, together with a total investment in these sets, plus that in fixtures, equipment, trucks, running above $20,000, the ultimate net profit went down toward zero.

When I say that I do not mean that the cost of doing business became so great that there was no net profit on the $100,000 worth of capital in use, but I do mean that after an interest rate of 17 per cent or more per annum had been set aside for the lenders of that capital, there was nothing left. In fact there was a deficit. There was still a profit being made, some profit, but not enough. It was but a fraction of the profit that was earned when the store sold only one make of set and kept its investment down to a low figure.

THE READER will have deduced from the foregoing that I am in favor of sticking with one or two sets. I am, yet not unqualifiedly so.

If you have a lot of money and operate a large store, it is probably more profitable to carry a number of lines, because it would take more than one, perhaps, to absorb your capital advantageously. On the other hand, if the dealer's resources

are under $15,000 or $20,000, it seems to me that he ought to figure long and carefully before taking on a whole mess of sets.

By limiting your line to one good make, you may reduce and will reduce your total sales, but you will be able to carry more of your own time-payment accounts. Inasmuch as there is a profit of from 17 to 30 per cent per annum to be made in carrying your own paper, you had better be darned sure that there is *more* than this amount of profit for you in the selling game itself. In getting at the amount of net profit in the selling part of your business, you must figure in, not only the usual overhead expenses, but also the losses involved from repossessions and bad accounts. If you'll do this carefully and coldly, you'll probably be surprised to find that there is easier money in carrying good instalment paper than there is in retailing radios. That's why millionaires run finance companies instead of retail radio stores.

In other words, analyze your situation and see in cold figures whether it is more profitable and satisfactory for you to sell two sets a week and take all the profit in those sales, or six sets a week and share the profit with a finance company. There is a certain point where you will come to a balance, and that point will depend on several factors, but principally on the amount of your own working capital. Given a large amount of capital, then the governing factor is largely a personal one; any dumbbell with a million can run a finance company hock-shop if he will just be sure he buys nothing but well-secured paper, particularly third-down stuff; but it takes a pretty smart guy to keep a million working profitably in the retail merchandising game.

From the salesman's standpoint, the one-set system is certainly the only one whereby he can do good work. If the salesman is fully sold on one machine, he cannot display much enthusiasm over any other. When the Gray Company carried only the Imperator, it was, in my firm opinion, the best buy on the market—and I still think so. When we carried ten lines, we still boosted for and stuck to our first love, carrying the other nine makes for the accommodation of customers.

Whenever there was any sign of indecision in the buyer's mind, we invariably tried to swing him toward our Imperators, with the consequence that our books showed almost 40 per cent of our business was in this one make. This again brings out an interesting and significant fact. With a stock of 20 Imperator sets we were turning over more than 70 a month; with 60 other sets of nine miscellaneous makes we were making from 80 to 100 sales a month, a lot of them sales that didn't stick.

In other words, we were making several times as much profit on our favorite line as we were making on all the other makes put together. Of course it is true that if we had thrown out all the other lines we would not have sold so many Imperators—but we would have been a lot better off any way, as we could have operated with but a fraction of the overhead that was involved in handling the ten lines.

There is of course no question that the dealer who sticks to one set, and only one set, is going to lose sales. It's certain to happen. The prospect will want to try other makes. You may have had a set on demonstration and the customer may like it, but if he's determined to try something else, it may be impossible to close him. Off goes the prospect to try the next machine, perhaps several machines, and in the end he may decide to buy the make you tried to sell him, but he's now in the hands of some other dealer and you don't get the sale. By carrying a number of lines you can keep the prospect in your own store. If he really wants to buy a radio at all, you are pretty sure not to lose him. This was the principal reason the Gray Company took on so many machines. As a result, few live prospects ever got away—but on the other hand the expense of keeping any from doing so was too great—too great in capital tied up, in delivery and demonstration cost, in salesmen's time.

THE tendency of the prospect to want to try a number of sets is more and more prevalent and is really a serious matter to the one-set store. There is a little dealer out in a California town who has developed a "system" that to my mind is absolutely a knockout for a one-set concern. It's a kind of super "dynamiting" stunt that I never saw anybody else work, and he's making a killing with it. Here's the way it goes.

This dealer gets his set into the home of his prospect and make a demonstration. Then when told by the prospective buyer that he is going to try some other make, the salesman, after vainly doing his best to close, finally says, "Very well, Mr. Jones, if you want to try an Eerie Shriek, why I'm acquainted with a young fellow who's specializing on that line. If you'll let me use your telephone, I'll call him and arrange for him to bring an Eerie Shriek out for you to compare with our Imperator."

Of course the customer's eyebrows go up at this and he wonders what sort of dodge the salesman is up to. Then the customer is given further selling talk, the upshot of it being that the salesman is so sure of the outcome that he is willing to risk a comparison with an Eerie Shriek or any other darned old set the prospect expresses an interest in. This, tactfully done, will very often convince the undecided prospect that he has the one best set in the world; but if he can't be closed, the salesman is as good as his word and calmly calls the dealer handling the Eerie Shriek and asks that he bring out a set for demonstration.

Strange as this tactic may sound, it certainly tends to make a tremendous impression on the prospect, and the competing set is three quarters licked before it arrives. The customer is secretly doubtful that it can be so hot if the Imperator man is so sure of himself as all that.

The outcome was very often that the first set stayed and the other went back. In fact, in that particular town it has come to the point that competing dealers have learned their lesson and some refuse to deliver a machine for trial against the set on demonstration—and that settles things quick.

It takes a little nerve and quite a lot of good salesmanship to put this system over, not to mention a lot of tact. It is essential that the salesman handle the situation skillfully, to keep a sensitive prospect from thinking that the salesman is trying to make a fool out of him. If the salesman is really and honestly sold on his own set, he will not have any trouble; the customer will be impressed with the air of certainty with which the salesman regards the outcome.

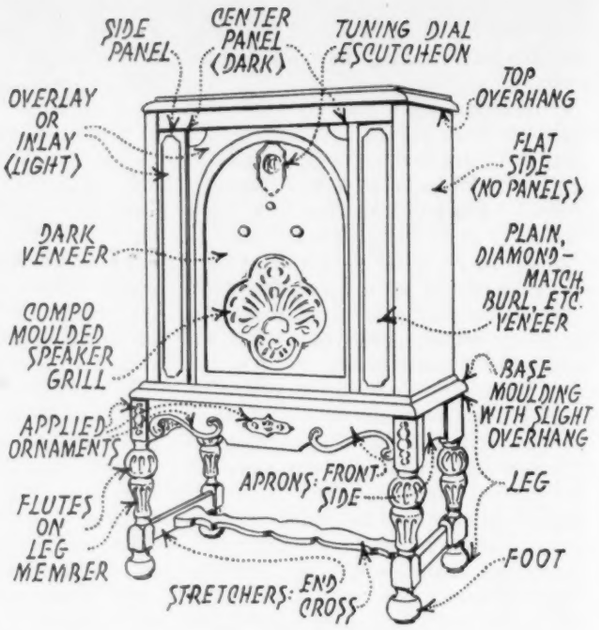
It is obvious that this system will not work if you are selling an inferior machine, but if you have a good one—any good one—and the price is right—you can with safety work this system, and it will get you many a sale. There is no use denying that in some cases the prospect will buy the competing machine. That's in the cards; you can't help it, and the little profit you lose in losing that sale is as nothing compared to the expense you would be put to if you tried to carry enough lines to insure closing each and every prospect who lets himself into your hands.

Why not sell one darned good set, and one only, and let the other fellow do all the hauling back and forth of scratched and battered merchandise?

(Continued on Page 52)

Radio Cabinet Materials *and Construction*

By H. L. PARKER



The Parts of a Radio Cabinet

EVERY radio salesman should know something about the various kinds of woods, their finishes, and the methods of construction used in the furniture which houses the radio chassis. While this information is often essential in closing the sale of any receiver, it becomes doubly so if the furniture is to conform to a certain period.

Walnut is used in perhaps nine-tenths of the cabinets now being made. It has a fine grain and takes a high polish. Its uniform grayish-brown shade, with black streaks running in all directions, can be easily matched in "occasional" pieces for the home. Its chief drawback is its susceptibility to injury from rough handling. As ordinarily used as a veneer for exposed surfaces it may be more expensive than mahogany.

The popularity of mahogany is due to its beautiful grain and its ability to take a high polish easily. It can be shaded from a deep red to dark brown, is not likely to shrink, is easy to work, and holds glue better than any other wood. Less expensive and less desirable woods, like beech, cherry and birch, can be stained to imitate it.

Maple, birch, oak and gum are used for sides and sometimes tops and fronts of medium and low-priced cabinets. Some of these woods are used for legs and stretchers in quite high-priced cabinets. As shelves for chassis, separators of speaker compartments, reinforcing, etc., pine and gum are satisfactory in any priced cabinets. Redwood is particularly desirable for such use because it is "dead."

The use of metal cabinets will probably not become extensive until an acceptable finish is discovered. Some attempt has been made to imitate wood finishes on sheet metal, but this has not yet appeared in a form that is accepted by many women for use in homes. For a time, table model receivers in metal cabinets sold extensively, but novelty metal finishes were employed rather than any attempt to imitate wood.

Veneers

MANY people still have a lurking suspicion that veneered woodwork is somewhat of a sham. This is probably due in part to its more general meaning "to gloss over, thinly, superficially," and also that veneer formerly had a tendency to peel off. If the ancient cabinet makers had possessed the modern veneering machines and understood the chemistry of glue as it is now known, veneers would have been more generally used.

Most wood has a tendency to warp or shrink. A laminated or plywood board is built up of three or more layers of equal thickness, with the grain of adjacent layers laid at right angles to each other. (Fig. 1.) When the surfaces

Fig. 1. Construction of Three-Ply Board

are carefully prepared and properly glued together with good glue at the right temperature, a board is secured which is more expensive and better in many respects for cabinet work than a solid board of equal thickness because it will not shrink, warp, crack, or split as easily as the solid board.

Cabinet plywoods are generally three-ply or five-ply, ranging in overall thickness from ¼ to ¾ in., in which each ply, or layer, varies from 1/16 to ¼ in. All woods vary in density, hardness and appearance of grain, and therefore vary greatly with respect to their susceptibility to various stains, varnishes and lacquers, and methods of applying these finishes. In plywood, the outer layers, or at least one outer layer, is some wood which has a more beautiful appearance or finishes more easily, while the core of inner layers is often of a different wood, probably less expensive or more abundant, but which has equal or greater strength than the outer layers. To insure against warping or shrinking, better veneering boards use a "dead" wood for cores.

Veneered wood is plywood in which the outside plys are thin sheets varying from 1/30 to 1/16 in. in thickness of some rare and beautiful wood. The most beautiful woods are too small and too rare to cut into thick boards. These perfect, attractive, but small pieces are sliced into thin sheets, each slice numbered as it is cut so that grain appearance will be uniform when several of the small, adjacent, numbered slices are glued on to a wide surface of some less expensive wood core. Some of the most beautiful veneered woods are the mottled, variegated shaded "burls" which are sliced from knots in a tree. For more decorative panels, rare woods (for veneers), such as rosewood, Italian olive, satinwood, African cherry, French walnut, sandalwood, ebony, etc., are imported; and native woods like birdeye maple, pear, mulberry, etc., are used. Some of the small pieces of these imported rare woods are more expensive than hand-carved ornaments of native woods.

Ornamentation

THE art of decorating flat surfaces by cutting away parts of the solid wood of the ground board and inserting pieces of different colored woods, or pieces of ivory, pearl, tortoise shell, etc., is called "inlay." Both the cost of the actual operations plus the artistry required for "inlay," which keeps the whole surface flat and smooth, is more expensive than for "overlay" which easily describes the placing of pieces of odd colors of wood over a flat surface. Marquetry differs from inlay and overlay, in that an added design is partly set into the flat surface and partly raised above the flat surface.

"Compo"ornaments, in which 90 per cent of the material is ground wood, are today available in beautiful designs. Their component parts are stronger and less likely to break than real wood carvings. Compo ornaments made of material other than ground wood are questionable, because they are likely to chip off easily.

Because of additional labor costs and superiority, plywood should be more expensive than solid boards; and in the case of veneered boards, the still greater cost of securing and preparing beautiful specimens is warranted, because without the use of veneers it would not be possible to have the beautiful cabinet work available today. When a cabinet is described as "solid mahogany" or "solid walnut," it is quite apt to be less desirable in strength and durability than a plywood cabinet with veneers of these woods used for outside surfaces.

Therefore, today, to say that a cabinet is veneered is more apt to be a mark of distinction and superiority than a sign of inferiority.

Constructional Details

THE purchaser of furniture is at the mercy of the manufacturer to a greater extent than in any other type of commodity sold through retail trades. Outward appearance can sometimes be misleading even to experienced furniture buyers; therefore the latter lean heavily upon the trade reputation and general integrity of manufacturers.

There are many grades of furniture, and the output of different factories is definitely classed as low-priced, medium-priced and high-priced furniture, because, as a policy, certain factories cater definitely to only one of these classes. Their factory equipment, class of workmen, factory methods, etc., are deliberately planned to meet the standards for a certain grade of furniture, and the reputable factories make no false claim as to the grades they produce. As in almost any line of business, there are unscrupulous manufacturers who take advantage of the inability of the purchaser to easily identify quality of wood, construction details normally concealed in completed pieces, and especially in the matter of finish, wherein the purchaser is almost wholly dependent upon the word of the maker.

If good materials are used, corners well reinforced, joints well made and properly glued, it can be more easily sold even though its style may not be right up to the moment. But if it is poorly constructed, poorly finished, in addition to being off style, it is apt to stay on the dealer's floor for some time, or to revert to him after it is sold. When sold on long-time payments, it should stand up at least until the dealer collects his last installment.

When properly made, even a square, plain-glued joint will be stronger than the board itself, without using tongue and groove or dowel pins. Glue, for instance, should be kept at a uniform temperature by use of thermostatically controlled heat. If allowed to reach—say 150 degrees temperature, its life will be lost; but unless the workmen are properly supervised, they can easily let out hundreds of pieces that will later cause the retailer much grief.

Dovetailed corners are seldom used nowadays, except for drawers. Cheap furniture from a poorly equipped factory may have butt or rabbeted corners; but a mitred corner joint is preferred because the end grain cannot be seen at outside corners. All of these should be reinforced.

Cross members should always be joined to uprights by a mortise and tenon. Shelves for support of chassis, power packs and speaker units should be of thick wood, not less than ¾ in., preferably a dead wood that will not warp and throw the chassis out of line with the control knobs and escutcheon plates on the outside front, or twist the frame to an extent that will put ganged condensers out of trim. About the only place a nail is ever used in a good cabinet is to temporarily hold shelf cleats in place until the glue sets to hold them securely. Screws and dowel pins only are used by good factories wherever joints require anything other than glue.

A two-part cabinet body, illustrated in Fig. 2a should have as the bottom part a separately constructed framed member which is securely screwed to the top section. This type of construction will be from 15 to 20 per cent more expensive than that shown in Fig. 2b, where the corner posts are continuous and form the main structural frame for the whole cabinet.

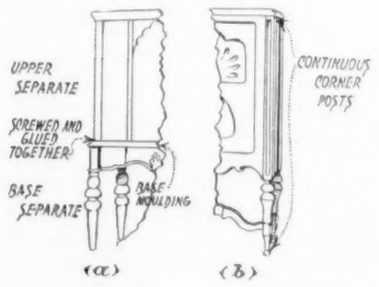
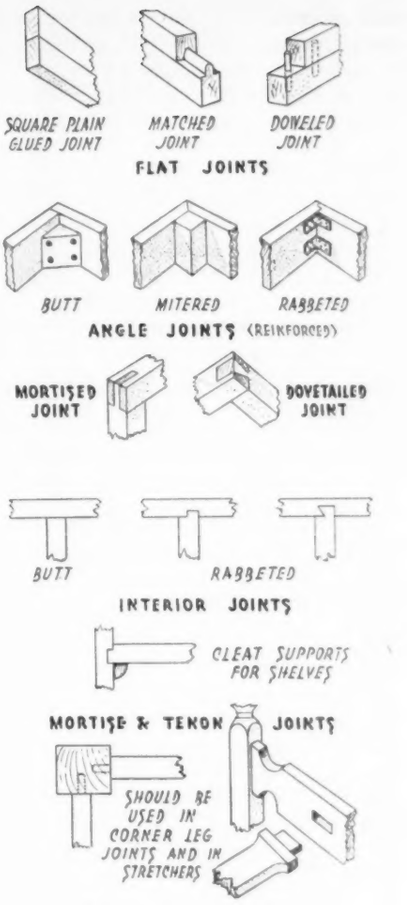


Fig. 2. Two Types of Cabinet Bodies



Various Kinds of Joints

Doors should be hinged with invisible hinges, and be constructed so as not to mar the finish on front or sides when opened flat against those surfaces. Other things being equal, doors add to the cost of a cabinet. Other visible hardware, latches, etc., varies greatly in price. Brass or bronze is most expensive; but cast-iron, with clean, well-defined details and the outside plated finish protected or insured by a heavy under coat of copper plate, will outlast brass with a cheap plated or sprayed finish.

To a radio user, nothing can be more annoying than the howl set up by the combination of a microphonic tube and sympathetic vibration of the speaker diaphragm. A construction of the body of the cabinet which avoids thin, long members, or thin supports for speaker or chassis, lessens the opportunity for this annoyance. Cabinet resonance, especially the deep boom in the tone of many receivers, is likewise objectionable to many listeners, and is the result of cabinet-body materials and design, for which there is no excuse. The use of wood of sufficient thickness and strength application of suitable sound-absorbing

wall material, the proper placing and size of openings in the back of cabinets, or some combination of these three factors, can entirely eliminate this fault before the set leaves the factory.

Finish

THE finish of furniture is one point upon which the dealer must rely upon the word of the manufacturer. This is a good reason for knowing something of the reputation of the furniture factory that makes the radio cabinet. On lowboy cabinets for sets listing under $125, the cost of finishing may be less than 50% in labor, and over 50% for materials. On $200 sets, labor may cost 60%, materials 40%. And on sets over $350, the labor may cost 75% to 85% of the total factory cost of finishing, and materials from 25% to 15%. The trade standards are enameled, varnished, lacquered and waxed. The three last may have the final coat applied so that the result is either high polished or plain.

Good finishing must start with a smooth surface. Then a "filler" applied to fill up the tiny holes; then stain, separately or mixed with the filler where color is desired; then varnish lacquer or wax, as the case may be. To better appreciate the fact that labor is such an important part of good finish and therefore susceptible of cheating, the method employed by a firm noted for the excellence of its finishes on polished surfaces is summarized by the finishing foreman as follows:

"In order to secure a good piece of work, it is absolutely necessary that the woodwork be made perfectly smooth with fine sandpaper before starting. Then: (1) fill with best grade of filler; (2) if color is required, color with filler or with stain after filler is applied; (3) apply a thin coat of best shellac. After dry and hard, smooth with fine sandpaper; (4) apply three coats of best varnish, allowing each coat to dry for at least two days; (5) when dry, rub down each coat of varnish until very smooth surface is obtained, with pumice stone and felt, allowing one more day to dry after each rubdown; (6) final rubdown with a roller stone, and for extra fine finish rub only with palm of hand; (7) clean entire surface with equal mixture of raw linseed oil and turpentine, then rub down with clean cheesecloth."

The process is approximately the same for enamel and lacquer, as for varnish. In inferior work, saving in labor starts with omitting to work the filler well into the pores of the wood, or in not rubbing superfluous varnish (or lacquer or enamel) away after each coat, but in putting most of the labor on the last coat only. These finishes may look attractive when new, but shortly scratches will show up, the surface chip easily, and after the top coat is worn through in spots the whole area peels off, changes in color or otherwise shows up the attempts to save in its cost.

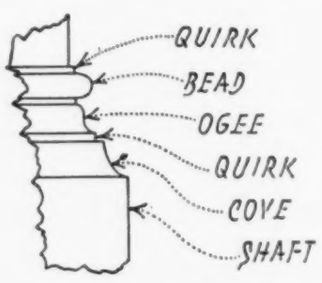
About the only saving that modern methods have to cut the cost of really good finishing is in the use of spraying equipment instead of hand brushes. While spraying varnish, lacquer or enamel reduces labor costs, it is really more efficient because a more uniform thickness of each coat can be applied, therefore requiring less labor for rubbing down. For any of these finishes, each coat adds from 15% to 20% to the actual factory cost for finishing.

Enamel is paint in which varnish replaces linseed oil, or is oil-paint with varnish added. The pigment is a part of the mixture. A real enamel surface can be built up, layer after layer as described for fine varnishing, which is beautiful, smooth, easily cleaned, neutral and permanent.

Wax finishes are secured with various waxes in place of varnish or lacquer in the last one or two coats applied. It can be highly polished or left dull, as desired.

Only when honestly and properly done, can varnished finishes be considered today as desirable from a trade standpoint as modern lacquer finishes. Layer for layer, lacquer is more durable than varnish, and will not check nearly as quickly as varnish, especially if the latter is of poor grade, or poorly applied. On very cheap radio cabinets, two coats of lacquer, only, may be expected; three coats a fair average on a little better grade of goods; four coats on medium-priced furniture; and six coats on high-grade cabinets. Of course there still exists the chance that rubbing labor will be skimped between coats, but as lacquer can be well taken care of by fine sandpapering between coats, and because it dries very quickly as compared with varnish, one is more apt to get, these days, a more durable lacquer job than a varnish job on radio cabinets.

A checked varnish surface is difficult to repair; the most expert finishers are lucky to get satisfactory results in about three out of five such jobs tackled. On higher class work, the last lacquer coat will be carefully hand-rubbed; and on cheaper work the rubbing will be replaced by a finish coat of "flat" lacquer, which is lacquer with a pigment added to kill the high gloss and give a rubbed-effect. It surely is all up to the factory. The average radio dealer can only hope for the best where so many radio cabinets are made in wood working factories under contract with the radio receiving set manufacturer.



Descriptive Trade Terms

Packing marks, paper marks, hot-dish spots, heavy lamps, vases, etc., can cause any dealer a lot of grief, even when the customer is honest and admits cause of the fault. The better the original finish, the better are the chances of repairing such blemishes. Dented wood and scratches can be filled with melted stick-wax and colored to match the original finish; then rubbed and treated by various means.

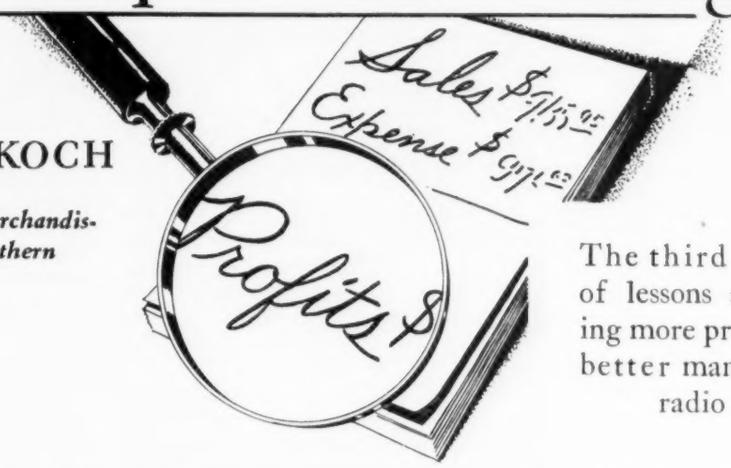
Sooner or later every dealer must learn as much about servicing woodwork on cabinets as he now knows about the electrical and mechanical parts of the receiver. Because radio dealers in general know so little about woodwork and wood finishes, there is always more or less feeling between them and their factory suppliers, because the radio dealer, inexperienced in the customs of the furniture business, expects every piece of merchandise to reach him in perfect condition.

Experienced furniture dealers know just what to expect, and all of them are equipped to touch up packing and shipping marks as well as more serious damages, counting it as a part of their overhead. Most good furniture dealers will also alter the shade of finish on a whole bedrom set, or dining room set, to make a sale. Sometimes, if refinishing will be too costly, a price is quoted for doing the work and agreed upon by the purchaser. A radio cabinet can often be refinished, at least in shade, at a cost of $5 or $10, which can either be absorbed by the dealer in a high-priced set, or charged for on a lower list priced set.

I. C. A. Short-Wave Kit

The Insuline Corporation of America is selling an a-c short wave kit whose tuning procedure is claimed to be exceptionally easy. It requires a '24 tube in the r-f stage, a '27 in the detector, '27 tubes in the first two aduio stages and a '45 tube in the last audio stage. The kit consists of several completely assembled units ready to be mounted on a drilled metal chassis and to be interconnected by marked measured leads without soldering. It uses eight plug-in coils whereby it is possible to cover all wavelengths from 14 to 600 meters. All parts are completely shielded and designed for maximum efficiency. A separate unit supplies the necessary power from either 50-60 cycle 110 volt on 220 volt source as specified. A similar model is made for d-c operation.

PROFIT PROMOTION *through* Proper Store Management



By **WILLIAM E. KOCH**

Associate Professor of Merchandising, University of Southern California

The third of a series of lessons about making more profit through better management of radio stores.

SUPPOSE some inquisitive chap should "up and ask you": What is the force that drives your business? What is the power that makes it go and keeps it going?

Suppose also that you really want to give this man your best possible answer; not a none-of-your-darn-business type of answer, which might well be the first that pops into mind. Just suppose all that.

Well, under those circumstances, what would your answer be?

Deep interest in the radio business? Necessity of making a living? Desire to be of some use in the world? Got in and can't get out? Must have something to do? Want to make all the money I can?—Or what?

All such answers might be looked upon, in a way, as stating the driving force of your business. Yet they are, of course, more particularly along the line of reasons for being in it. When we get right down to the real power that makes the business go and keeps it going, we find it nothing more nor less than brain power—just ordinary human intelligence, properly applied.

We all know that, of course. Yet every radio dealer can increase his profit by giving more consideration to this fundamental fact that brain power is the mainspring of his business. This is especially true when he remembers that *"the essence of intelligence is ability to see relationships."*

When all is said and done, the continued success of every business is determined by the condition and relationship of its essential parts. The radio store is no exception. So it is well to turn our thinking back, just for a moment, to the three basic essentials in the profit-producing process as presented in our first lesson:

Adjusting the "Working Parts" of the Profit-Making Plan

The "working parts" of the business determine the result of our planning and acting and controlling. The big call for managerial brain work is in placing and keeping the essential parts in proper relationship. Picturing the fundamental profit-making plan in figures serves as a guide to maximum profit. The unavoidable difference between mark-up or discount and margin must be taken into account.

1. Planning (determining what is to be done, and how).

2. Action (doing it).

3. Controlling (making sure that it is done as planned).

The more we study these basic essentials the clearer we see why and how they are the real bedrock upon which the continued success of every business must stand, and that the big call for managerial brain work is in placing and keeping our planning and acting and controlling in proper relationship—in adjusting them, and maintaining the adjustment.

The "Working Parts" of the Business

EXACTLY the same principle of relationship applies to the "working parts" of the business. These parts determine whether or not our planning and acting and controlling produce the desired result in profit. So we need, first of all, a clear mental picture of just how they work together in the production of maximum profit—the *finished product.*

Consider any mechanism by way of example. Take the radio, which is a "machine" whose finished product is entertainment and education and home-making influence. It has essential parts which determine efficiency, and the degree of efficiency depends invariably upon these two things:

1. Whether each working unit is right in itself.

2. Whether all of the working units function together harmoniously—coördinate properly.

Likewise in every business, be it large or small, there are certain essential "working parts." No radio store or any other kind of business can exist without them. They were mentioned in our preceding lesson—*sales, stocks, margins, expenses.*

Of course we all know well enough that each of these basic elements is necessary in making the radio store produce a profit. Indeed, it is the very obviousness of the fact which makes it necessary occasionally to remind ourselves that our profit volume is determined by their working together properly, as well as by the condition of each.

Planning the Essentials

SO WE proceed with the study by turning our thoughts briefly to the basic essential of planning as applied to the four fundamental elements or "working parts." This brings us right up to one of the most important steps in the entire process of profit producing.

We may well call it "planning the essentials," because that is what really is necessary. Only the most fundamental phases of our profit-making program can be worked out deliberately, and be put down in black and white. Nor is more than that ordinarily necessary.

Be it ever remembered, in considering the four essential working parts, that no one of them can stand alone. No one of them is fundamentally more important than the others. No one of them can be slighted in planning if the

business is to produce all the profit it is capable of producing. The general situation may be summed up like this:

After recognizing the profit-making influence of the working relationship between the basic essentials—planning, acting, controlling; the next important requirement in planning for profit is to recognize the profit-making influence of the operating relationship between the fundamental working parts — sales, stocks, margins, expenses.

This point of relationship cannot be emphasized too strongly. It presents a basic need which calls for some real study to place it most effectively on the job. But the necessary planning is a profitable investment of mental energy for any radio dealer because it is sure to measure the ultimate return that comes to him as pay for his hard work and inevitable business risks.

Different Terms Used in Planning

SOMEWHAT different terms are used in referring to the "working parts" in speaking of them as planned and as actually accomplished. This is necessary because we need to know whether we are referring to what has happened or to what is expected to be made to happen.

Custom has established suitable terms. Planned sales are known as sales quotas; planned stocks, as stock limits; planned margins, as mark-ups or discounts; planned expenses, as expense budgets. So we use these terms in formulating a clear plan of how the four fundamental "working parts" of the business are to function.

This sort of planning means, simply, that we determine for a definitely fixed time period ahead, and as accurately as the available information and vision will permit:

1. What the amount of the sales volume at the expected retail prices for that period should be.
2. What is the minimum investment in merchandise with which the planned volume of sales should and can be reached.
3. How much of an average mark-up or discount is required to produce the margin that is necessary to cover all cost of doing business (visible and invisible) and leave the desired profit.
4. How much expense or cost of doing business will be necessary in carrying out the fundamental profit-making plan consistently.

An Illustration with Figures

LET us now work out a fundamental plan with figures, just by way of illustration. The figures are not expected to fit any individual radio store. Their purpose is merely to present the simple plan more clearly. Each radio dealer will find it decidedly helpful to change the figures and make them fit his own business as accurately as possible.

Suppose we are formulating our fundamental profit-making plan for the year ahead and have reason to believe that the store can and will, in that period, sell merchandise amounting to $60,000 at expected retail prices. We then have our first rough figure for the profit-making plan: Sales quota, $60,000.

We turn next to the important item of stock limit. We must determine the minimum investment in merchandise with which we can reach our sales goal. This is ascertained easily when we know the number of times our stock of merchandise should be turned during the year.

Suppose we expect to turn our stock six times, or once every two months on the average. Then, by simply dividing our sales quota ($60,000) by six (expected number of stock turns), we find that the retail value of the average stock to be carried is $10,000.

We need also to figure the stock limit in terms of cost or wholesale value, which is easily done when we know the average per cent of mark-up or available discount from list on the entire stock. (We will hereafter refer to this item as mark-up only—the difference between the cost price and the marked retail price.) If the average mark-up happens to be 40 per cent of the retail value, the cost value of the average stock is $6,000 ($10,000 less 40 per cent).

Next comes the total amount of mark-up on all of the merchandise to be sold during the year. This is $24,000, 40 per cent of our sales quota.

Mark-up and Margin

BUT mark-up is one thing and margin is another. The total of all price reductions expected to be made during the year must be deducted from the total mark-up to establish the expected margin. And be sure to remember that margin, not mark-up, is the profit producer.

Margin, you know, is what is left of the mark-up when the goods are sold—and paid for! Mark-up is what we try to get; margin is what we succeed in getting. The difference, when not fully provided for in planning, is responsible for much of the surprise that comes so often at the completion of our profit and loss statement.

Should we happen to have no definite figures on previous business to help us determine what the unavoidable reduction of the total mark-up will probably be, we simply apply an estimate that is based entirely on memory and observation.

Let us assume that this reduction is expected to amount to two per cent of our sales quota, or $1,200 for the year. That will make our expected margin 38 per cent, $22,800 in amount.

This brings us to the "last, but not least" — the expense budget, which should always be worked out with particular care. It will be given more consideration in a subsequent lesson. For the present, we will simply assume that the complete expense budget has been made up and is found to call for an expenditure of $19,200—32 per cent of the sales quota.

OUTLINE OF
A FUNDAMENTAL PROFIT-MAKING PLAN FOR THE YEAR AHEAD
(The store as a whole)

Sales quota (at marked prices)	$60,000	100%
Stock limit: { Retail value $10,000 / Cost value $6,000 } Six stock turns.		
Average mark-up on entire stock	$24,000	40%
Expected price reductions and losses (not otherwise accounted for)	1,200	2%
Expected margin	22,800	38%
Expense budget (expected cost of doing business)	19,200	32%
Profit (or loss) resulting from this plan	3,600	6%

NOTE: The figures are merely to help illustrate the plan. They are not intended to reflect any one radio store or any group of stores. Each radio dealer should change the figures and make them fit his own business as accurately as possible.

An Outline for Study

LET us now get this first rough draft of our fundamental profit-making plan into more convenient shape for study to determine whether it is as good as we can make it. To do this, we assemble our figures in simple outline form, somewhat as shown in the accompanying box.

Remember that the figures are used only to illustrate the plan. To get the most out of this study, just change the figures and make them as nearly true to reasonable expectations for your own store as you can. If some of the figures must be based on straight guess for the present, just make your best guess and then take a good look at the "picture."

Be sure to bear in mind that planned figures never can be more than estimated figures. Nobody can look ahead and tell exactly what will happen, but every radio retailer can guess at what reasonably may be expected to happen in his business. A guessed-at plan will at least make a start.

Those who have accurate figures for the past are obviously in much better position to estimate consistently than those who depend entirely on memory and general observation. Those who do not have the required figures at present, will be fairly sure to develop them when they see the practical value of deliberate planning for profit.

(Continued on Page 52)

Selling *Sound* Equipment

By HENRY L. WILLIAMS

Amusement Parks Are Good Prospects

PREVIOUS articles in RADIO have indicated the wide scope of the market for public address systems and centralized radio. The purpose of this article is to describe some of the conditions that will be met in breaking into the sound field and some methods that have successfully been used in combatting them.

First of all it should be realized that sound equipment merchandising is Big Business. There is no room for the piker, nor the one-man concern trying to get by on a shoestring.

Much harm has been done to the industry in the not-too-distant past by pseudo-sound engineers who peddled the equipment at cost, relying on installation charges for their remuneration. There are still many of these in existence, carrying their offices in their hats and leaving their "sucker" buyers to damn all sound equipment when they cannot be found to remedy the defects that always arise in "haywired" jobs. Newcomers to the business in almost any community will find plenty of victims of this type of selling who have to be unsold before they can be sold. Like most evils, however, this minor epidemic is not without its benefits: it has at least convinced many sound users that it pays to deal with substantial concerns; to buy only quality equipment of national reputation, and to put performance before cost.

It is for this reason that there is at the present time a widespread demand for specialists in sound installation. The day of the dabbler and "peanut" concern, if not already past, is fast departing. Both the trade and their clients are coming to realize very plainly that the installation of even the simplest of public address systems calls for more than a knowledge of how to hook up sundry pieces of apparatus. It is a specialized business, and as a business it has to be handled along business lines if the customer is to get what he pays for and the engineer his rightful profit.

At the time of writing there are three main types of sound engineering concerns. One type sells and installs the products of one special factory, such as Samson or Western Electric. They pick their lines of associated apparatus, such as amplifiers, microphones, pickups and speakers, and specialize on this one group of products. Another type of concern offers any make of equipment that it can secure, the brand being determined by the price they think they can get for the job. The third kind build up their amplifier equipment from some special line of parts, and may or may not specialize on any one line of speakers and microphones.

As time goes on it seems that the class first mentioned are in the ascendent. There are many advantages in tying to one line only, particularly if those lines are the products of established manufacturers who are acknowledged leaders in their fields. In the first place they have the advantage of the manufacturer's advertising. It is a great help in selling if the customer is already familiar with the products through advertising, for it is a peculiar psychological fact that, in these technical matters, the layman purchaser does not feel so much at a disadvantage when discussing something of which he has read and therefore with which he feels himself familiar.

Another benefit in specialization is the close coöperation obtainable from the manufacturer and the manufacturer's representative. The makers will always help those who are pushing their lines, by advice, the provision of special selling ammunition, pictures and details of installation similar to that projected, and the production of special equipment. Last, but not least, they will always give the contractor the benefit of full discounts and special price advantages. These are the reasons why many sound engineers work closely with the local factory representatives, obtaining from him leads arising out of factory inquiries, and taking advantage of his local stock which enables them to keep their inventory at a minimum.

In contrast to the specialist concern, the contractor who supplies any make of equipment specified suffers the disadvantage of working under smaller discounts as a rule. Instead of being classed as distributors, such companies generally operate on dealer discounts, a handicap that may make all the difference between profit and loss. Then, too, they have not the full coöperation of the manufacturers who are not likely to stand behind their installations in the matter of guarantees nor support them with the prestige of the factory.

There are several installation engineers who have built up enviable businesses on the sales of assembled amplifier equipment, but these are in the very small minority. In the first place, it is very difficult to build up equipment that can be guaranteed to perform exactly as it should when installed, and be perfectly reliable over a long period of time. Even when this is done, there is the disadvantage of high cost, for no custom-built job can compete with the factory product of a first-class manufacturer. The main argument of these contractors is that each job can be engineered to suit the special requirements of the installation, but they overlook the fact that present-day factory-built equipment is so extremely flexible that almost any requirement can be met, without excessive cost. In addition to this, the larger factories maintain experimental laboratories which are constantly discovering newer and better ways of securing the desired results, while the assembler plods along in his old groove, relying on slowly accumulated experience to show him the need for improvement.

Breaking Into the Sound Business

ONE of the first things to be settled before the first prospect is approached is the composition of the internal organization of the company, and, secondly, the mechanical equipment.

There are those who maintain that a sound equipment salesman should have a thorough technical knowledge of the products and the engineering principles involved. This seems to be a mistaken idea, for there are very many successful salesmen who have only an elementary

idea of electrical theory. It is, however, practically an impossibility to entirely divorce the two requirements, and there is very little doubt that the most successful salesman is he who at least has some idea of what he is talking about when he recommends an installation of one type or another. That is to say that the man should first be a salesman and then an engineer, and not an engineer who is trying to be a salesman.

After all, selling a sound installation is not the mere peddling of assorted units of apparatus, as so many seem to think. An installation must be sold as a unit, and no man can sell such a unit unless he knows the whys and wherefores, the functions and capabilities, of each integral part of that unit.

One of the most successful ways of selling a sound installation is first to have the engineer survey the job, prepare a rough layout and estimate, and have the salesman take a concrete proposal to the prospect. So very few good prospects really know what sound equipment is and what it can do for them. To take them a complete picture of the proposed installation simplifies matters greatly for the salesman, besides creating a good impression on the potential customer.

Selling sound equipment is a good deal like selling advertising. The good advertising salesman first familiarizes himself with his prospect's business and aims, and presents a tentative plan to show how that end can be facilitated by judicious advertising expenditure. So with the sound equipment salesman. He must know what his customer's problems are and be able to show him exactly how the installation will help him, and just what it will cost him to get that help.

When a customer has been brought to the point of active interest, in nine cases out of ten he will want a demonstration. Now demonstrations can be of two kinds (a) a laboratory demonstration, or (b) a demonstration under actual operating conditions. Most of them call for the latter, but it is far more satisfactory from the engineer's standpoint to make the demonstration in a room or outdoor place equipped for the purpose. The reason for this is that most demonstrations are more or less hurried; the equipment is haywired together, and the experimental work necessary is often unavoidably carried out in the presence of the customer or his associates. Poor operation, even though in the course of testing prior to demonstration, usually gives a bad impression, and first impressions are often difficult to overcome.

The ideal way, therefore, is to have some standard equipment mounted and wired in a demonstration room, so that it will unfailingly operate perfectly from the minute it is switched on. No demonstration should ever be attempted without the most thorough and painstaking preparation, and sloppily assembled equipment should never be displayed. Such assemblies look complicated and untidy and can rarely be relied upon.

When it is absolutely necessary to make an outdoor demonstration, equipment should be used that has been properly assembled and thoroughly tested in the shop, and it should be taken to the job neatly mounted in operating condition on some kind of rack so that there will be no hooking-up to be done on the ground. Another thing to be avoided in demonstrations is the use of ordinary twisted pair for speaker, microphone and other leads. The job should be wired with just as much care as the finished job would be, and should look just as neat. Only then will the demonstration be 100 per cent satisfactory. Demonstrations therefore call for (a) one permanent assembly in a demonstrating room, i. e., microphone, phonograph, radio tuner, amplifier, and speaker with the necessary switching panel, (b) a portable rack assembly in which any or all of the above can be incorporated at will.

This leads to the consideration of an important factor in securing sound equipment business—rentals. In the majority of metropolitan centers there is a brisk demand for temporary installations, or the renting of speech and/or music equipment. It is astonishing how often such rentals lead to sales, either to the hirer or as a result of the publicity secured. Every sound installation concern, therefore, should have at least one separate portable installation set aside for rental. A speech or music assembly can often bring in fifteen to twenty-five dollars a day, and may very soon pay for itself and make a nice profit into the bargain. Even if it did not, it would be justified by the leads it established for sales.

Given the necessary manpower and equipment, the next thing the installation company has to consider is the securing of prospects. Two important sources already have been mentioned—the factory representative and the rental business. There are, fortunately, many others. It is very easy to get lists of new public buildings, projected and under construction; new hotels, hospitals, theaters, apartment houses, ballrooms, ball parks, airports, stadiums, parks, department stores, restaurants, schools, etc., ad infinitum. Building permits and trade magazines are prolific sources of leads. But once given a start, the wide-awake salesman will stumble over more prospective business than he can handle. The real problems arise in getting the business after the prospect has been tracked down.

Much, then, depends on the engineer. He it is who must determine whether the installation calls for horns or baffles, the type of speaker needed and the amount of power to be supplied to each control of acoustic qualities, the placing of the equipment and the types of units to be used. And these things determine the final cost, and what is more important, the satisfactory performance of the installation, which, in the final analysis, is the true basis of success in the sound equipment installation business.

LONG HOURS AND HARD WORK SPELL PROFIT FOR SALESMEN

SELLING is a profession, and to make a success of any profession calls for continual hard work. A successful salesman works as long hours as a successful doctor, lawyer, school teacher, or minister. The first necessity in selling, regardless of ability to sell, is the number of calls per day, and a large number of calls cannot be made between 9 a. m. and 4:30 p. m. with time out for lunch.

I know a salesman, a star in the builders' supply line, who received the foundational order of what is now a good account at eleven o'clock at night. No, not across a table in a night club, but in the buyer's office and over a buyer's desk.

It was a cold morning in the winter, stars were still in the sky, when a salesman picked me up at the cross-roads where I was waiting for the first interurban to town. "Out this early, Ben?" I said.

"Sure. Every morning. Charley Shultz at the Oak is the first stop today. He's open at six-thirty; not busy, and that's when I can get his attention. I'll close the day with Henry Regent over at the Bliss. If I call on Henry during the rush period I get thrown out. Always time myself to be there when the rush is over."

"That's long hours," I said.

"Sure. This was once a two-man territory; now I cover it alone, and I've got it where it pays a four-man income. Tired! Bosh. It isn't work that tires me—it's worry. When I get home at night my family greets a good-natured dad, for, no matter how business is, I've made it good."

Yes, there are buyers on the job both early and late. A salesman may get by on six hours a day, five days a week, but he'll get a great deal further on nine to ten hours a day, six days a week.—*Coöperation.*

Selling Radio *by Recorded Music*

THE piano is always a good instrument with which to demonstrate a radio receiver. Its low notes are lower than any orchestral instrument except the bass viol, the sousaphone and the bassoon. Its highs are higher than those of the piccolo. It is played by what a radio operator would term "impact excitation," and is therefore very difficult to reproduce. Before electrical recording of music was developed it was almost impossible to record the piano in anything like its natural likeness; now there are piano records that, when reproduced by a fine instrument, can thrill the greatest of musical critics. Such a one is the Brunswick 90068, produced in Europe, and recording Chopin's Fantasie Impromptu G Sharp Minor on one side and Mazurka B Flat Major on the other. Both are played by that master pianist, Alexander Brailowsky, and both are most inspiring to anyone who allows music to inspire him. The Mazurka is very short; a great advantage in a demonstration.

VICTOR No. 22528 is a clever dance number, featuring two pieces from the new talkie, "Check and Double Check." Duke Ellington and his orchestra do the work; Three Little Words, being the first selection and Ring Dem Bells, the second. Good syncopation is the keynote of both sides, while Ring Dem Bells is outstanding for the extreme clarity of the orchestra bells. It is, for that reason, excellently suited for the demonstration of high frequency reproduction; and it is interesting to note that the usual tone control will remove all trace of the bells when the highs are cut. It is not often that a high note is isolated so that the average radio set prospect can study it. Another point in favor of this selection is that the most necessary vocal refrain is extremely short.

EDDIE DUNSTEDTER has a very fine organ record out now; Brunswick No. 4902; playing O Sole Mio (My Sunshine) by E. di Capua, on one side and Ciribiribin, a waltz by Pestalozza, on the other. Both are played in the theatrical style, using various combinations of stops which give those effects so typical of the theater organ. And both are popular with lovers of classical music and jazz music alike. This is one of the first points in choosing a record with which to demonstrate a radio combination; be sure that it is the type of music the particular prospect enjoys.

PROKOFIEFF: Love of the Three Oranges; by Desiré Defauw and the orchestra of the Brussells Royal Conservatory; Columbia No. 67812-D; is a splendid orchestral record. It is an imported record, of course, and very well recorded. It is played in two parts, starting out with a staccato march, featuring especially the highs by the chimes, violins and piccolos. Suddenly the music changes to a soft, legato melody that is very pleasing and contrasts greatly with the opening strains. In Part 2 the bass viol carries the melody for quite a time, giving the salesman a splendid chance to show off the receiver's ability to play the low notes.

UNLIKE the butcher, who used every part of the pig but the squeal, the scientist, physicist, radio engineer, or whatever Theramin calls himself, has made use of the radio squeal; the good old "bloop" that used to aggravate all the radio fans in the neighborhood during the revered one-tube days. The latest thing in musical instruments that is beginning to achieve great popularity is the Theramin, a vacuum tube instrument. There are two rods extending from the cabinet of the Theramin and as the player moves his hand toward the right one he varies the pitch, while a movement of the left hand controls the volume. Naturally, then, the artist cannot go from one note to another without slurring. However, in Victor Record No. 22495, Lennington H. Shewell plays a couple of Theramin solos with piano accompaniment, and plays them in a way that establishes the Theramin once and for all as either an orchestral or solo instrument. Playing Lover Come Back to Me, from The New Moon, on the first side Shewell makes that offspring of radio stand up and talk. It has all the fullness and richness of the viola or violin. Then the artist drops an octave and the instrument sounds very much like a 'cello. While it gives a slightly similar effect to that of a musical saw, due to the slurring, there is a world of difference in the fullness of tone. The Theramin is rich in harmonics; a fact easily proven by manipulating the tone control and noticing the difference as the harmonics are cut off. The second harmonic is so strongly reproduced that it sometimes sounds as if you hear two instruments playing an octave apart.

On the other side of the record Shewell plays Dancing With Tears in My Eyes. In this piece he brings out some beautiful low notes, perhaps below the range of the 'cello and into that of the bass viol. As a record for demonstration purposes this one is probably one of the best ever reviewed in this department. The highs are splendid and the lows are magnificent. And all are sustained so that a good comparison may be made.

THE string bass, or bass viol, is not often considered a solo instrument. But after hearing Serge Koussevitzky play Valse Miniature and the celebrated Minuet in G, by Beethoven, one is liable to change his mind about the instrument's capabilities. Victor No. 1476 records these two selections, and is a record that ought to be on every radio dealer's shelf, especially due to the fact that it is such a splendid example of what bass music can be. Serge Koussevitzky is the conductor of the Boston Symphony Orchestra, one of the foremost organizations of its type. As a virtuoso of the double bass he is admittedly without peer. The Valse Miniature, one of the selectons played on this record, is his own composition.

FOR those who like Rudy Vallée and his Connecticut Yankees Victor No. 22489 will serve as a good demonstration record. On it are recorded Good Evenin' and Just a Little Closer, both foxtrots. While neither selection shows anything especially suitable for the purpose of demonstrating radio quality, they are typical of a class of music of which a certain percentage of American people are most appreciative. If a prospect gives the impression that she would rather hear Rudy Vallée slide through one of his crooning melodies than listen to Brailowsky rattle the keys of a concert piano, or Mengelberg direct a great symphony orchestra in the playing of an overture, be sure that Rudy Vallée will more than thoroughly demonstrate the phonograph combination than the piano or the orchestra.

Radiotorial Comment

By the Editor

CONTRARY to original estimates, crude radio movies bid fair to enter the home before the talking movie. The enterprise of the makers of receivers and kits, in contrast to the lethargy of the film producers, is responsible. The areas where radio movies may be viewed are limited, as are likewise the areas where the equipment can be sold, but with expansion in broadcasting facilities the number of these areas will increase. The results are still crude, but recognizable, especially when line drawings instead of photographs are used.

Radio Movies Impending

Both the NBC and Columbia chains are experimenting and have applied for station licenses. They are planning to be prepared "when and if the broadcasting of pictures may become as widespread and practical as the present network broadcasting of sound." There is no question as to the "if," but only as to the "when." Every day brings the reality of this dream a little nearer.

NOISY radio sets were responsible for nearly one-eighth of the complaints investigated by the New York Noise Commission. They were exceeded in number only by the complaints about noise from automobile traffic and electric transportation. Thoughtless operators of radios in homes caused 7 per cent of the total number of complaints and of radios in stores and on the streets 5.36 per cent. This may be one reason why more radios are not being bought. Yet no radio need be a nuisance if it is operated with regard to the comfort and feelings of other people. Every set has a volume control. Why not use it?

Minimizing Radio Noise

EVERY once in a while some one has a sales idea which is good except for the fact that it is contrary to the law. Many an otherwise good plan has been abandoned because it conflicts with the laws intended to prevent restraint of trade. Fewer instances have been recorded of violations of the laws which govern radio transmission. But recently an Illinois manufacturer has developed equipment to open and close a garage door by radio. He apparently does not know that the law prohibits the operation of an unlicensed transmitter, and a spark at that. So this plan, no matter what its other advantages, is foredoomed.

Illegal Transmitters

ONE of the reasons why people like to listen to the radio is because it is cheerful. They can always hear some program that will lift them out of the gloom that sometimes comes with business depression and unemployment. While there is no glossing over the fact that this year's loss in purchasing power, as compared with last year, may amount to 3½ billion dollars, everybody would like to forget it once in a while and think about something cheerful. Radio gives them this something.

Radio Business Improving

With the energetic efforts that are now being made to relieve the jobless there is ample assurance that comparatively few people will not be provided with such necessities as food, shelter, clothes, fuel and light. These necessities formerly demanded about three-fourths of the income of the average American worker, leaving one-fourth for various sundries, including radio. Nowadays they demand four-fifths of the income, leaving only one-fifth for sundries.

There are a host of demands upon this twenty cents out of every dollar, each competing with the other. The industries which supply these sundry demands were the first to suffer from under-consumption. They represent comforts, conveniences and luxuries which are not absolutely essential to bare living. People want them but can't afford many of them until the retail prices of the necessities have been reduced in the same proportion as the prices of the non-essentials have already been cut.

The radio business, in particular, will start to be good when this twenty cents for marginal expenditures again becomes twenty-five cents. Marked reductions in the cost of living are equivalent to an increase in real wages. Such increase in wages gives more funds for sundries and means the employment of more people to supply the demand for them. This sort of economics places business on a sound and stable basis.

In this connection it is to be noted that all the modern sundries which make life worth the living have come as a result of scientific research. While business has been halting, science has been marching forward and has been getting ready a host of new things which people will want and which will put more people to work. Not the least of these are in the field of radio, which has a brilliant future for all those who can survive the present unpleasantness.

Keep Radio Out of Politics

GOOD broadcasting is admittedly the most important factor in the continuance of public interest in radio. Anything that helps the broadcaster, helps radio sales by assuring better programs. Anything that hurts the broadcaster, hurts radio sales. So every radio merchant has a personal interest in those things which affect the broadcaster, whether it is the radio advertising that pays for programs, the musical copyright fees which tax the broadcaster, or the governmental regulation which limits his activities.

Governmental regulation of broadcasting was originally in the hands of what is now known as the Radio Division of the Department of Commerce. When the courts decided that this Division did not possess sufficient authority to enforce its regulations, Congress established the Federal Radio Commission to bring order out of chaos and then, after one year, to turn the job back to the Radio Division.

The Federal Radio Commission has now been in existence for nearly four years. While it has improved conditions, the improvement has been no greater than might have been attained by the Radio Division, which has continued to function in a diminishingly important manner as the Commission has gradually usurped the Division's powers. The latest example of this is the Commission's taking over the licensing of amateur stations. The tail has begun to wag the dog.

None might object to the extinction of the Division, as its duties are assumed by the Commission, were it not for the manner in which it is being done and were it not for the nullification of Civil Service protection. The Commission and many of its employees are well paid political appointees. The Division is made up of poorly paid Civil Service men. Political patronage determines one, technical merit determines the other.

Joint Senate Resolution No. 176, which may be enacted during the coming session of Congress, proposes to transfer all the Division functions to the Commission. On the other hand, H. R. 12948, as introduced by Representative Sirovich, would vest the Commission's authority and powers in the Department of Commerce and constitute the Commission as a Federal Radio Board of Appeals. Either of these measures, if enacted, might be superseded by the pending Couzens' communication bill to establish a new commission to regulate all telegraph, telephone, cable and radio companies which transmit intelligence for hire.

That some change in the method of controlling broadcast station activities is about to be made is clearly evident. It is also evident that the change which will be most beneficial to the radio industry is one that would conform with the doctrine of "less government in business and more business in government." Nowadays, government in business means politics in business.

Consequently, for the good of the radio business, it is sincerely to be hoped that the regulation of broadcasting will not be dependent upon political expediency or upon the fear or favor of any one political party which may happen to be in power. Regulation is necessary, but it should be impartial.

Have Confidence and Courage

AFTER urging confidence and business courage as necessary precedents to the return of prosperity, Eugene R. Black knocks the props from under his argument by saying that we cannot pay our debts if we continue to live in the automobile and radio era. Mr. Black is governor of the Federal Reserve Board at Atlanta. His statement is quoted from a speech that he gave at a bankers' convention. In the words of *The Texas Weekly* of Dallas, "we are wondering whether he was inadequately quoted by the Associated Press, or whether the sentiments expressed really represent the deliberate and sober judgment of a man representing such a position of economic leadership."

His argument is typical of that of the crape-hangers throughout the land who say "Business is dead; therefore let us all prepare to die, or at least go back to the era when the horse was the fastest thing on land and the sail the swiftest thing on the sea." Is this confidence; is this courage?

Contrast it with the statement of Sayre M. Ramsdell, Philco's sales promotion management: "There is plenty of radio business to be obtained if you make people want your set bad enough and set a price they can afford to pay." He evidently is confident that American standards of living are to be maintained and is courageous in making it possible for the American people to continue to live in a radio era.

Or contrast Mr. Black's black outlook with the statement of Edward E. Schumaker, president RCA Victor Co., "that the causes of the present depression have been removed and what the people and the business of our country now need is confidence, in order that we may have an early recovery. . . . . We as a people have not during the past year lost our desires for comforts and luxuries. . . . What we need is the kind of courage that is born of confidence and good judgment." His company is producing 8700 radio sets daily and giving employment to 25,800 people at Camden, N. J.

Other radio companies are doing likewise. Most of these sets will be sold this year to people who will and can live in a radio age. Pessimism may delay, but it cannot stop progress. History shows that every business depression has been marked by four successive phases: a stock market crisis, a decline in commodity prices, extreme pessimism, and the return of prosperity. Prosperity will come when pessimism has been dispelled.

Some *Tips* on *Bookkeeping*

[Conclusion of article on Opening the Ledger in October RADIO.]

By G. S. CORPE

IF YOUR business is just being started the opening of the ledger at first is about the same as already explained, except that you will have fewer entries. Suppose you invest $1,000 in cash and are ready to open your ledger and have done absolutely nothing else; you would start the ledger out with only two accounts; Cash in Bank, Debit $1,000; Investment, Credit $1,000. From then on each transaction will be first entered into the cash book and the entire story of the business would be contained in the cash book and ledger, right from the beginning.

If you make a number of bank deposits through the month take your bank book and add the deposits indicated therein a few days before the end of the month and see that the resulting figure agrees with your Total Cash Received Column in your cash book. If it doesn't agree find out WHY and make it agree. Cash is darned funny stuff to handle and has a most unhappy faculty of getting out of balance.

On the last day of the month get your cancelled checks from your bank and go through them, making a list of written but not back at the bank checks, and see that the bank balance shown by the bank's statement agrees right to the penny with your balance as indicated by your cash book. File the list of checks not yet back along with the returned checks and at the end of the next month do the same thing. Don't depend upon the bank's figures at the end of the month for your cash balance; you may have hundreds of dollars of checks out and not yet returned to the bank. Get your cash balance always from your own books.

If your business is large enough to require an income tax return you will find there is nothing to equal this system for having the necessary figures available, quickly, easily, and accurately.

For income tax purposes it is necessary to itemize your general expense columns for the year. Separate all the entries into their respective departments, such as rent, telephone and telegraph, electricity, advertising, etc.; type it all up alphabetically arranged and save the sheet for comparison in future years.

Occasionally an entry may be put in one of the miscellaneous columns that just cannot be separated into any definite department. If so, ok; carry it along and post it to the ledger; and when you get ready to take inventory and pull out a profit and loss statement, close the miscellaneous account by posting it to the profit and loss sheet just as you do general expense or any other account. But keep the balance in the miscellaneous account just as small as possible; the smaller it is, the more accurate your accounting is, of course.

In order to simplify things as much as possible no mention has been made in the examples of equipment or furniture and fixtures, Test sets, meter boards, etc., should be carried in a ledger account as equipment. Tools may also be carried in the equipment account but most dealers prefer a separate account for them—just call it "Tools." Your books will be more accurate as at the end of a period you can take off more discount for depreciation on hand tools than you can on most larger equipment. Desks, shelving, and showcases are of course furniture and fixtures. The standard allowable depreciation per year on these items is: Tools, 33 1-3%; Equipment, 25%; furniture and fixtures, 20%.

After you get your trial balance each month better make up lists of the following accounts and be sure they are accurate and agree with the trial balance figures:

Customer's accounts.
IOU's from finance companies.
Notes receivable.
Notes payable.

In making the list of customers' accounts I suggest that you head up four columns on a piece of blank paper, like this:

Name	Total Due	Bot Last Mo.	Bot B4 Last Mo.

The total of the two right-hand columns should of course equal the total due column, which should in turn agree with the trial balance figure. Keep the total of that last right-hand column small. If an account gets into that column it should have attention and be collected promptly. Don't be afraid to be a good collector.

Trial balances have a great habit of not balancing, and a few suggestions in helping locating discrepancies may be of benefit. If the columns do not balance subtract the smaller figure from the larger, and look through the cash book columns for that amount; you may have forgotten to post some account to the ledger. If the amount you are out of balance ends in an even number divide it by two and multiply it by two and look for one of these amounts in your trial balance columns; you may have put a figure in the wrong column, and this procedure will locate such an error quickly. One of the most common errors of those of us who do not work with figures all the time is transposing figures. This means writing $45.00 as $54.00, or writing $20.25 as $20.52. Take the amount you are off balance and if it is possible to evenly divide it by nine the chances are you have transposed a couple of figures somewhere. Anyhow if one transposition is all that is throwing your trial balance off the amount you are off will always be evenly divisible by nine. By using reasonable care at all times you will have no great difficulties; and I never get over marveling how two long columns of apparently dissimilar figures will add up to the same amount when everything is correct! You will certainly find it fascinating.

I'll bet someone is wondering why or how we could sell $2 worth of sheet music as entered on the income side of our cash book when we did not show any on our original inventory when we first opened the ledger. I wanted to have that entry to especially emphasize the caution about inventorying things plenty low; the explanation therefore being that when we took inventory we had some old sheet music lying around that we considered too worthless to bother to figure in our inventory. But when we sold it we credited the sale to sheet music, since we had that column. That's all—the lesson to be learned is: Always inventory anything and everything plenty low.

The best of us will get an occasional account on our books that can't be collected and finally we get so disgusted with it that we want it out of our sight. But we can't just cross it off our list of customer's accounts and forget it because if we do so we will never be able to make our list of customer's accounts balance with our trial balance amount again. It must be properly entered in the cash book first and then crossed off the list. We can handle it in two ways.

(Continued on Page 54)

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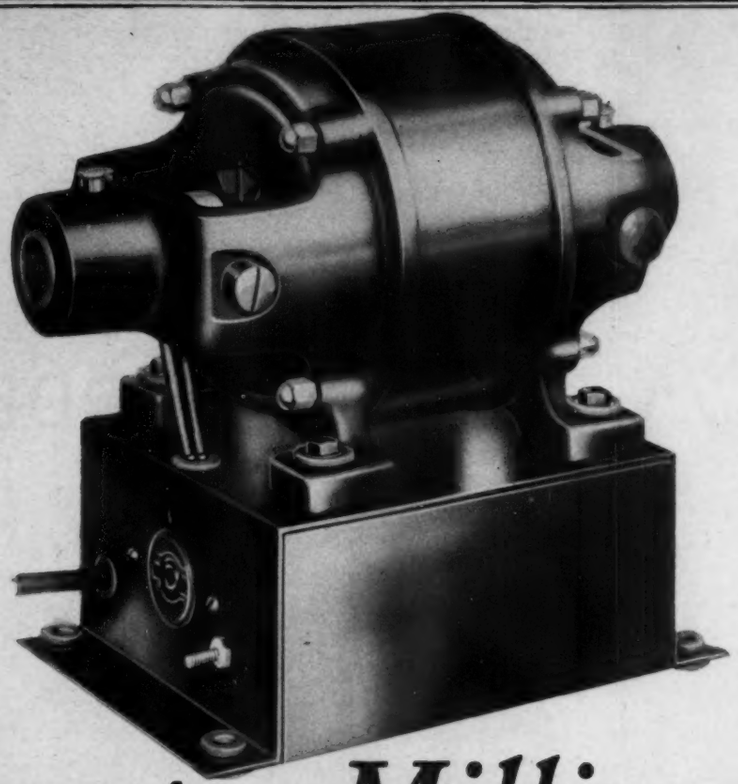

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The JANETTE operates quietly. Has double-wound armature. Perfect filtering—not a trace of ripple or interference in the receiving set. Capacity 110 watts.

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Tried and proven mechanism as used in Senior line for the past year. Twenty-one records, both sides. No rubbing together. Cabinet by Berg — Grand Rapids. "Nuff Said." Ear Level Music —found ONLY in Concert-Trope. Tone units giving the ultimate in tone. This new low priced quality instrument will open profitable fields for the dealer.

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RADIO MANUFACTURING PLANTS

Night scene of the "Radio Capital of America"—the great RCA-VICTOR plants at Camden, New Jersey, where production is running full blast with 25,800 employees. 8,700 sets are built each day.

The huge stockroom of the Silver-Marshall plant in Chicago. From here the materials for the SILVER Super-Heterodyne are distributed to the various assembly departments.

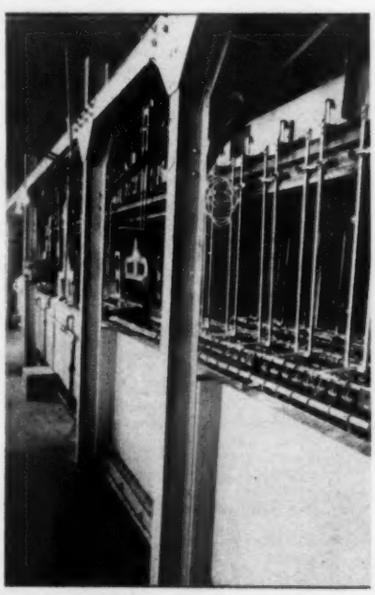
SILVER MARSHALL FACTORY—A BUSY PLACE

The coil winding department of the Silver-Marshall factory is shown above. Each coil is given numerous tests before it is finally assembled into a receiver.

An exclusive photograph showing the birthplace of Silver-Marshall, Inc. The second story of this building in Evanston, Illinois, was occupied for the manufacture of radio parts in the early boom days of "fan radio." The Silver-Marshall factory of today covers a large tract of land in the industrial district of Chicago.

Howard W. Sams, General Sales Manager of Silver-Marshall, Inc. He tells us that the factory is working a night shift and that Silver-Marshall super-heterodynes are tested for distance range by broadcasts from KFI, Los Angeles.

Howard C. Briggs, Assistant Sales Manager of Silver-Marshall, Inc. He has just joined the company. Formerly with E. T. Cunningham, Inc. — previously with Majestic as Michigan district manager, and a year with the radio division of Kellogg.



A $50,000.00 Cadmium Plating Machine at the Steninte Factory in Fort Wayne

Harvey Harris of the newly reorganized Steinite Mfg. Co., informs us that the factory is now one of the best equipped in the industry. Practically all parts for Steinite sets are made in the Fort Wayne plant. The cadmium plating machine, here illustrated, automatically plates the chassis in one operation.

THE MEGA-COUSTIC
PROGRAM-REPRODUCER

A SELF CONTAINED ~HIGH GRADE PROGRAM SUPPLY SYSTEM ~AT A MODERATE COST

DESIGNED TO BE USED IN

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THE MEGA-COUSTIC PROGRAM-REPRODUCER is a complete self-contained unit supplying, through one or more loud speakers, programs from—

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Phonograph
Microphone (direct speech or music), with undistorted volume.

AN INNOVATION FILLING A NEED

THE MEGA-COUSTIC PROGRAM-REPRODUCER is the first instrument to supply a complete public address system in compact unit form (a wooden cabinet 45" high, 25½" wide by 24½" deep) and attractive in appearance, as may be seen from the illustration.

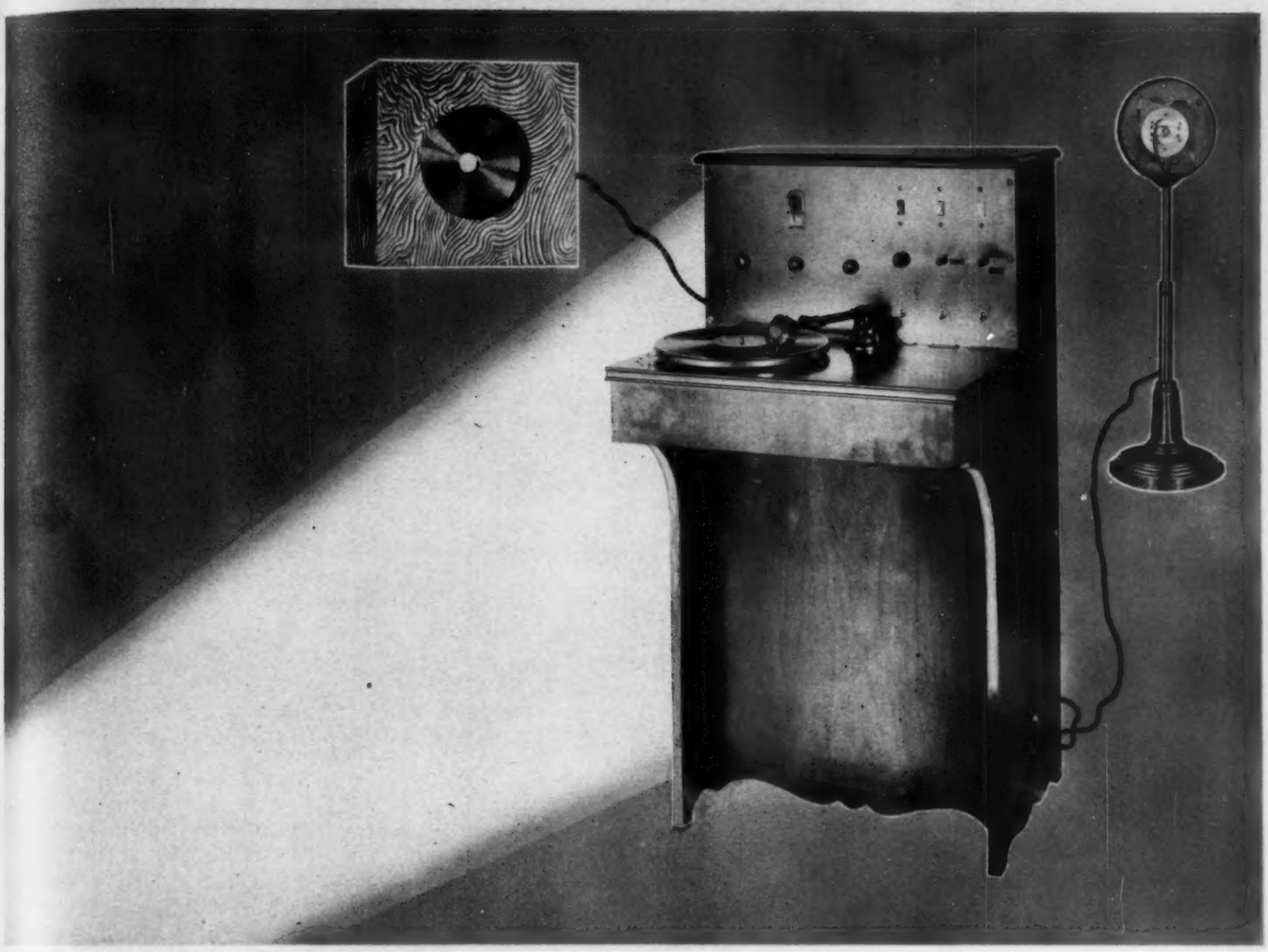
EASE OF INSTALLATION

The ease of installation is manifest. The cabinet is put in place and only three connections are necessary. An improper connection is impossible. It is easily moved.

1. Connection 110 Volt AC outlet
2. Connection for speakers
3. Plug-in connection for microphone.

OPERATION

Anyone can operate. Switches are marked and it is impossible to damage the equipment through mistakes. As easy to operate as a radio or phonograph. No intricate meters or complicated mechanisms, merely colored lights to show operating condition at all times.



THOSE WHO SPECIALIZE IN SELLING, INSTALLING AND SERVICING OF PUBLIC ADDRESS EQUIPMENT ARE INVITED TO WRITE FOR EXCLUSIVE REPRESENTATION FRANCHISES . . . . . .

A man who knows amplifiers—knows his market—knows of the potential profits which are in store for him—is the man we want to join forces with our amplifier building organization. Each territory will be allotted an exclusive franchise. Your territory is open. We are waiting for franchise applications from experienced amplifier specialists—men who know where to look for prospects—men who are in the business to make money for themselves and for us. Write or wire to—

AMPLIFIERS LIMITED

7 Front Street . . . San Francisco, California

THE KENNEDY FAMILY

No doubt about it—business is booming at the Kennedy factory. This photograph proves it.

Front row, reading from left to right: R. D. French, general manager, General Outdoor Advertising Co., Chicago; F. H. Wellington, Treasurer, Colin B. Kennedy Corporation; Colin B. Kennedy, President; C. J. Gale of the Studebaker Securities Co., Chicago; James DePree, general sales manager, Colin B. Kennedy Corporation.

Back row, reading from left to right: Ogden Johnson, account executive, General Outdoor Advertising Co., Chicago; E. M. Craig, Kennedy factory representative; Mr. Truen, Wm. Oaten and Clayton Stratton of the Kennedy-Detroit Co., Detroit, Mich., distributors of Kennedy radio receivers; J. Howard Haley, assistant to Colin B. Kennedy; W. E. Hathaway, general manager of the Southern Kennedy Co., Kennedy distributors for Baltimore, Md., and Washington, D. C.; and Larry Wall, advertising manager, Colin B. Kennedy Corporation, South Bend, Indiana.

KENNEDY CORONET

The latest addition to the "Royalty of Radio" line. A mantel receiver with resistance coupled amplifier, and SELECT-TONE CONTROL. 17" high — 16½" wide at base—10" deep and weighs 31 pounds.

GENERAL MOTORS DEALERS TO SELL FRIGIDAIRE

Electric refrigerator sales will bolster up business during the spring and summer months for many General Motors radio dealers. Radio receivers and electric refrigerators are complementary lines, in the opinion of R. J. Emmert, President of General Motors Radio, and E. G. Biechler, President of Frigidaire Corporation, who jointly made the announcement. 1,500,000 Frigidaires are already in use.

R. J. Emmert, President and General Manager of General Motors Radio Corporation.

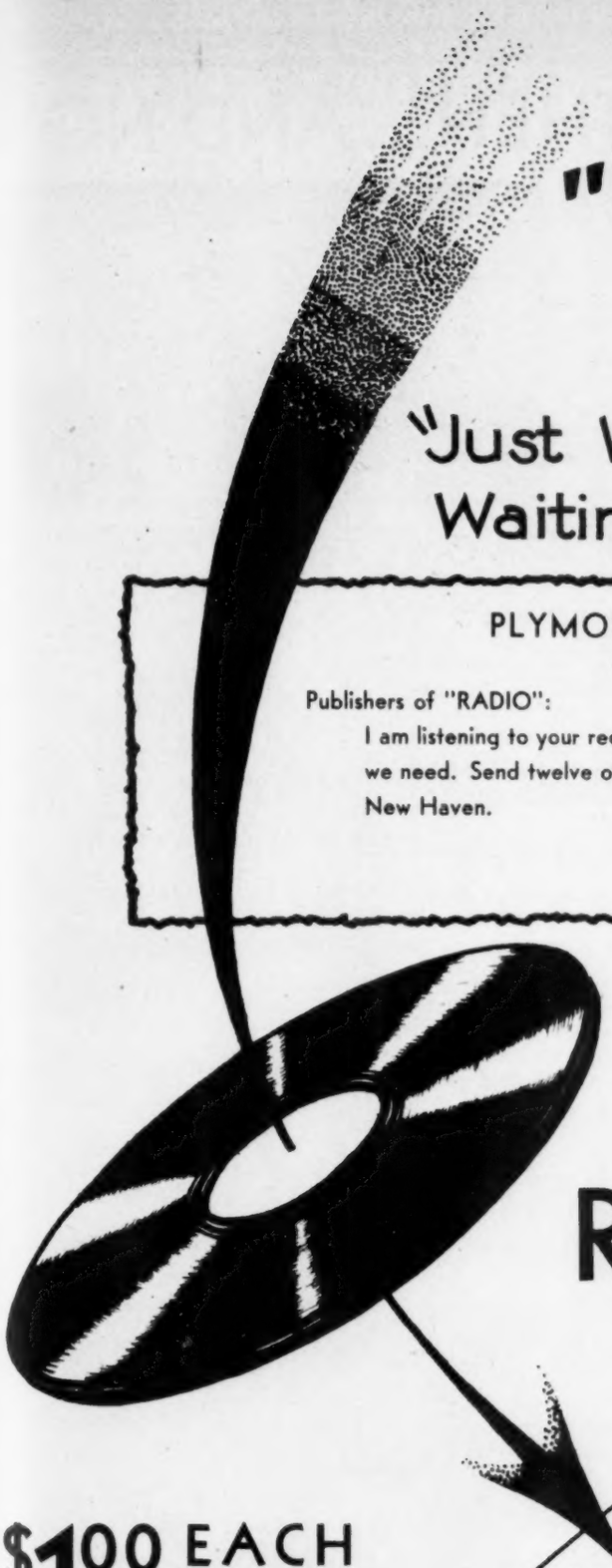
E. G. Biechler, President of Frigidaire Corporation.

ROLA ANNIHILATES DISTANCE

The Oakland, California, and Cleveland plants of ROLA are brought closer together with a Stinson cabin plane, purchased by H. S. Tenny, President of ROLA. He is seen in center of illustration above. At his left is B. A. Engholm, Vice-President. To his right is Leon Golder, sales manager, with headquarters in Cleveland.

SENTINEL REMOTE CONTROL DUOTROLA

C. H. Callies is now with Sentinel of Chicago. So is Alfred Marchev. One of the new Sentinel products is pictured here. Other new additions to the line are coming.



"That's It"

"Just What We Have Been Waiting For"... *Says the dealer*

PLYMOUTH ELECTRIC CO.
NEW HAVEN, CONN.

Publishers of "RADIO":

I am listening to your record in Steelman's showrooms. It is just what we need. Send twelve of these records at once to our main office at New Haven.

Very truly yours,
(Signed) PLYMOUTH ELECTRIC CO.

IT HELPS YOU SELL RADIO SETS

This Tone Test Demonstration Record enables you to make convincing, profitable demonstrations.

$1.00 EACH POSTPAID OR A STANDARD PACKAGE OF SIX RECORDS for $5.00

"RADIO," PACIFIC BUILDING
SAN FRANCISCO, CALIFORNIA

Ship ..... Tone Test Demonstration Records at once.

I enclose $ ..... in full payment.

Name .....

Street and Number .....

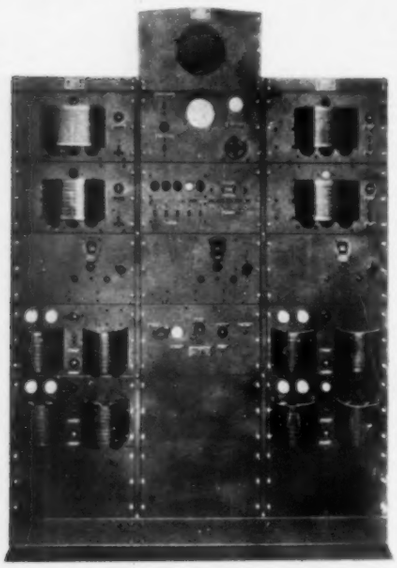
City ..... State .....

PRICES
$1.00 each postpaid or a standard package of six records .... for $5.00

THOUSANDS IN USE FROM MAINE TO CALIFORNIA

ATWATER KENT...THEN...AND NOW

An exclusive photograph showing the progress made in radio receiver manufacture by Atwater Kent. Storm and Shipley, Kent dealers in Frederick, Maryland, depict the progress made by displaying one each of every Atwater Kent model built since 1922. This attractive and unusual window display created much attention from passersby.



OPERADIO AMPLIFIER.

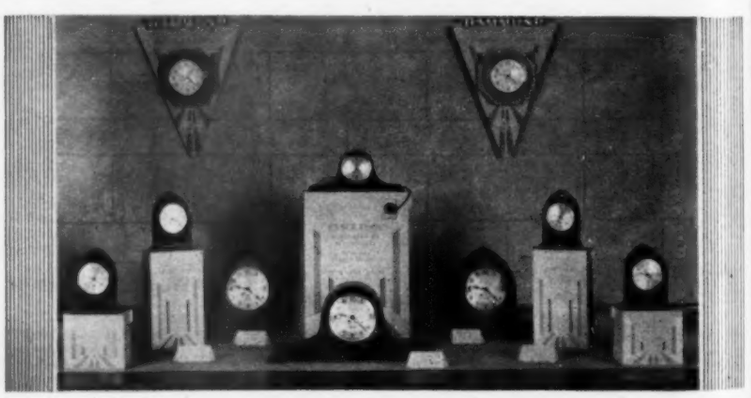
A four channel amplifier installation for a large St. Louis hospital was recently manufactured by Operadio of St. Charles, Illinois. It will operate 185 small magnetic cones. 50 head-phone sets and 10 large size magnetic cones for auditorium use on each channel. By means of this amplifier it is possible to make an emergency announcement in all rooms regardless of the channel from which any particular is being served.

THE OTHER EXTREME

From the "vest pocket" midget cabinet to the elaborate multi-purpose radio console. Here is shown one of the de-luxe custom built silver chest—writing desk—creations by SUPERIOR CABINET CORP. of Brooklyn, N. Y. Book case—silver chest—writing desk—electric clock — radio compartment.

List price, $500.00.

Louis Buehn, president of the Louis Buehn Company, Philadelphia, Atwater Kent distributor, presenting, in behalf of the Atwater Kent distributing organization, solid gold watch and chain of 83 links in a miniature reproduction of the Model 70 Atwater Kent Radio to A. Atwater Kent in recognition of his production of the 3,000,000th Atwater Kent Radio. The 83 link chain symbolized the 83 distributing links in the Kent organization.



A new and unusual type of window display was recently developed by the Hammond Clock Company of Chicago. The set consists of five pedestals for holding various models of the line, six price cards, and two triangular wall cards to hold the electric Kitchen Clocks. According to the "Hammond Times," the company's house organ, these displays can be had from the firm for the asking.

Supervision *of* Installment *Accounts*

The plans of small and large concerns which insure attention to accounts when needed.

By JOHN T. BARTLETT

NEXT to careful opening of installment accounts, nothing does more to assure satisfactory collection results than an efficient supervision system. The routine set up must be one which, from month to month, assures that delinquencies have attention when they need it.

These delinquencies, it can be taken for granted, will inevitably occur, so long as human nature remains unchanged. The disposition of customer is to put off, delay. A thousand and one things can arise to bring about delinquencies, which are seldom serious, if attention is given to them at once.

During any given year, investigation among radio stores show, 75% to 90% of all accounts on the books will require at least some collection attention. Summarized supervision plans of small and large stores will be presented here.

1. This store states that 90% of all installment accounts are paid out at or before maturity. When accounts are opened, there is special scrutiny of the risk. All accounts which, it is felt, need aggressive attention if they become delinquent, are segregated. Daily, working with a postoffice style cabinet, a separate box for each day, a trained girl telephones accounts which have become delinquent. Promises to pay are "tickled" ahead to the proper box, when telephone action occurs if payment is not made. As the telephone system fails to get results, the credit manager gives attention. A part-time outside collector is used.

2. The collection system of an Arizona store is built around a card file. A white card, with customer's name, ledger page number, pay date, is duly entered for each account. It is filed behind the guide for the date when due. There are guide cards for each day of the month. Cards behind the date cards are arranged in order according to ledger page numbers. Five colored guides are used for indexing for collection follow-up—"three-day letters," "ten-day letters," etc. A record of collection attention is carried along on the cards.

3. A large New York store. An account control number book is used. The number given each account has a letter indicating the due date. Ledger sheets are filed by both the number and letter. No letter is given a thirty-day charge account. If account is payable on the first day of the month, it is given the letter "A," if on the fifteenth, the letter "M." The letters I and O are not used, to avoid confusion, and certain letters control two due dates on which there are few payments. A card index file, alphabetical, is set up for accounts filed by account number. The posting medium is a receipt in triplicate. The customer is given the original, the bookkeeper keeps the duplicate, while the triplicate is the cashier's record of payment. In this store, the collection department works directly on follow-up from the ledger.

4. A Pacific Coast store determines due date, not by date of purchase, but by the customer's name. Payment dates through the month follow alphabetical classification. The collection department works through the ledger, after payment is due, down the alphabet. For each delinquent, a statement with three carbons is made. These are mailed at intervals of seven days each.

5. Addressing machine installations in some variety are found. In the steel filing cabinet used, four drawers may be used for each day of twenty-eight days, the last three days of the month not being used as due dates. Drawer A is for metal index plates of accounts not over thirty days delinquent. If an account is not paid, automatically, it is transferred to drawer B, later to drawer C, and still later to drawer D. Tabs on plates when switched left indicate unpaid condition. With equipment set to skip right-hand tabs, the notices are run off automatically. The system is worked out with attention to minute details; perpetual charts are provided for the operator. The system is one especially recommending itself to the store with a huge number of installment accounts.

6. Machine-posting systems incorporating use of a master ledger card on edge of which is a visible scale for collection control. There is a common use of a collector's card posted at same time as master card and kept in pocket with it until listed for special collection attention. The routine for analysis may send a trained employee over the ledger once every four days, or every seven days, or perhaps at a less frequent interval. The rapidity with which a trained analyzer can go over accounts is amazing.

The foregoing examples are typical of supervision methods followed for installment accounts. An efficient system meets several tests.

First, it secures attention promptly to all delinquent accounts, while assuring that they have continuous attention, as needed, until delinquency is terminated, or the account closed. Second, the system is studied for cost. Modern equipment will for hundreds of stores increase collection efficiency while lowering expense. Third, the system will secure special attention for accounts when they need it.

Commonly, there is a general system of follow-up at stated intervals, which is followed for delinquent accounts except as analysis indicates another course.

Some radio stores make the operation of the follow-up system almost 100 per cent impersonal. The delinquency notices go out to old and new customers alike, nor does the individual credit risk otherwise influence the procedure.

The more general system is for at least some modification of the system in cognizance of facts of the individual account.

When delinquency becomes serious, segregation which assures continuous special attention is always desirable.

Analysis plans vitally aid in supervision. A typical development of the idea regularly determines both the percentage and amount of delinquencies, and subdivides these by length of past due condition. From month to month the trend of delinquency is observed.

Every installment business chronically has a group of accounts, changing, of course, as to identity, which demands much personal attention. The use of "tickler," or 1-to-31, files, is often necessary to secure attention to all matters when they should have it.

Service First

By **FRED E. KUNKEL**

"We sell the best in radios" is the hard-hitting selling slogan used by Kennedy's Radio Store in Washington, D. C. The store features radio service and handles nothing but radios.

"We have handled as high as eight different makes," says Mr. Kennedy, "but we have settled down to two of the best radios on the market, and we prefer to confine our sales effort to machines which do not change in price constantly. We have also put out all kinds of advertising stunts to get people in, including newspaper advertising (which we have found valuable), and we have settled down to the idea that a good service man is the best walking advertisement you can have. We employ three service men, and the store is open every day from 8:30 a. m. to 10 at night.

"We specialize in service. We have the best equipment on the market, and employ only experts whom I have trained myself, and who have been with me for years. We are not constantly changing our radio service men. We pay them good salaries and they stay with us. We are primarily service and installation specialists. We would just as soon make all our money on service, as we would sell radios under conditions that have prevailed in the past. However, our service angle, along which we probably do the largest business in town, brings us in constant touch with the users who are in the market for other sets, for we carry only the best, and we talk them up religiously at every opportunity when the opening offers itself.

"Each service man carries a complete kit with him, interference locator, oscillator, large type Jewel a-c, d-c test kit, and a full line of accessories. Each man has his own car, and we pay them salary and commission. They pay for their own gas and oil. The commission is paid on set sales and only when the set is paid for. I call on the people myself to see if the service is all right. It is the best advertising in the world.

"We never trade in a set if there is any possibility for us to get around it. Our trade-in is practically nothing. We would rather lose a sale than make a trade-in unless the set is exceptionally good and we can get it at a very low price. We deal more or less with high class trade. We get quite a bit of the embassy business, and we have a regular clientele—a built-up trade. We have won complete customer confidence, and their praise of our workmanship, so that word-of-mouth advertising has been as helpful as any other means of getting business."

Around Kennedy's Radio Store, you will find attractive signs with a meaning, such as:

FREE * * $10

To the owner of any radio we cannot repair:

Of course you will be given an estimate before we begin and frank advice as to the advisability of having it done.

Service Above All

Another attractive wall sign includes the following statement: "Radio apparatus built to order—expert service on all makes," as a result of which, such business has been procured as amplifiers, extensions, and things like that.

Another thing about Kennedy's radio store is its environment. Here are Oriental rugs on the floor, or draped on the walls, some fine tapestries, attractive pictures, ship models on top of radios, red and blue lights, radio lamps, and what not. Even though the store occupies only a small space, Mr. Kennedy believes in atmosphere in selling radios. Then, too, these rugs and tapestries on the walls perform a signal service—they not only add a decorative note but they serve a most valuable acoustic purpose when the radio is being demonstrated, which greatly improves the tonal quality of the radio that is being demonstrated, and which makes for an absence of harsh sounds and grating noises.

Kennedy's collection system is pretty slick, too, and is thoroughly systematized. A visible card index is used, with signal tabs for different weeks and months of the year, so that he can pull out a drawer and in an instant find all payments that will be due during the first and second weeks of July, for instance, and then keep careful tab on installments as they fall due. "We have no collection department," he says. "If they are one week over-due, out comes the radio. We do not play ball very long. I attend to all the collections myself."

Kennedy services radio sets whether he sold them or not, and he has built up an enviable reputation for radio repairs and service. He finds that after people have their sets for six months or a year and trouble develops they look for a good radio service repair man because free service with a set is no longer available.

He uses a flat rate service charge, and by building up a big service business, he has sold quite a few accessories such as tubes, etc. The service man who goes out has a splendid opportunity to size up prospects for new sets or, by his direct contact, he can get leads to people who might be in the market. He knows just about what every customer needs in the way of new equipment, and he can talk with them about it and see if they are warm or cold. The average number of sales made as a result of service calls is better than 30 per cent. The service man, in fact, is the best salesman Mr. Kennedy has on his payroll, and all of his service men are well trained along the lines of selling. They quickly snap up cues and convert them into live prospects from which sales are subsequently made.

It has been estimated that an average of from 13 to 15 per cent of the total net profits that accrue to the radio merchant come from paid service. Mr. Kennedy does considerably better than that. In fact, he just about doubles it because service is the keynote of his business.

Present Owner Is Best Prospect

Who constitutes the best prospect for the sale of a new radio receiver? The man who has a set now, or he who has never possessed one? As answered by E. W. Butler, sales engineer of the E. T. Cunningham radio tube company, the majority honors go to the former class.

"At the present time," Mr. Butler points out, "the division of set ownership in this country is believed to be in the proportion of one set to every two families. This would mean that in a trading area serving 1,000 families, there are approximately 500 who have a radio and an equal number who have not. In the former class, probably half of the sets owned are over two years old. The 500 families in the area who do not have radios have been 'exposed' to radio for the past several years and 'it has not taken.' There are undoubtedly some very good reasons why they have not bought. Probably many of them have been unable to afford it.

"Based on the foregoing, therefore, it seems reasonable to assume that by far the greater percentage of receiver sales this year will be in the replacement field of new models for old. Inquiry reveals that this percentage of replacement sales has grown rapidly of late, as has also the tendency to have more than one set in the home."

NEWS *of the* Radio Industry

Kolster Reorganization Plan Approved

The common stockholders protective committee of the bankrupt Kolster Radio Corporation has approved the so-called Woodward plan for reorganization. The plan provides for a new company, capitalized at 5,000,000 shares of no par common stock, and $4,500,000 in ten-year 6 per cent debentures. In exchange for these securities, the new company would obtain all of Kolster's assets including $218,000 cash in the receiver's hands, also some 800 patents and other assets of the Brandes Corporation and other affiliates. Woodward agrees to purchase debentures at 90 and common stock at 9 to the amount of $4,500,000, which would give the new company that much working capital. The plan provides further for the issuance of one new share of common for each three old shares, and gives the right to purchase one new share at 10½ for each old share exchanged. Two shares of new common would be exchanged for each share of old preferred outstanding. Rudolph Spreckels and Frederick Dietrich would receive 200,000 shares of new common in exchange for their 80,000 shares of preferred and cancellation of $1,359,465 indebtedness.

Magnavox Wins Majestic Suit

The U. S. District Court in California has decided that dynamic speakers made by Grigsby Grunow Co., infringe on Magnavox patents and has enjoined their sale in California. A master in chancery has been appointed to make an accounting of profits and assess damages.

Magnavox Corporation has closed its Oakland, Calif., plant and moved to Chicago, where its headquarters will hereafter be located. The Fort Wayne plant is now in production on dynamic speakers.

Thirteen and Half Million Sets in U. S.

Radio receiving sets in use in the United States on July 1 were estimated by the Commerce Department at 13,478,600. New York, with 1,752,000, had the largest number. California was second, with 1,470,000 sets, or more than several states which exceeded her in population. Other state totals were: Illinois, 1,060,000; Pennsylvania, 977,000; Ohio, 845,000; Massachusetts, 656,000; Michigan, 627,000, and New Jersey, 450,000.

Too Soon for Home Talkies

The delay in the commercial introduction of home talkies, according to L. G. Pacent, is due to the non-availability of a sufficient number of satisfactory sound picture films. Good reproducing equipment is ready but there are not enough films to justify its purchase. "To proceed at this time would be to proceed on a flimsy foundation. It would be an injustice to jobber, dealer and ultimate purchaser."

Capehart Sound System at Griffith Stadium

A Capehart Sound System, installed at Griffith Stadium, Washington, D. C., by Thomas A. Curran, is used to

Capehart Sound Equipment at Griffith Stadium

furnish announcements, Amperian music or radio features. The installation is portable and may be used outdoors or indoors. It stands 48 in. high and occupies 24 by 36 in. floor space. The metal cabinet houses amplifiers having a maximum capacity of supplying 147 magnetic speakers. This installation is typical of what wide-awake dealers are doing to add to their sales volume, especially in the sale of records for the automatic record changes.

Crosley Business Improves

About half of the sets now being made by the Crosley Radio Corporation are midgets. September sales showed an increase of 25 per cent this year as compared with last year. October orders were greater than for any similar period in the history of the company.

Success of Synchronization

M. H. Aylesworth, NBC president, has advised the Federal Radio Commission that WEAF, WGY and KDKA have been successfully synchronized on 660 kc. Following this statement, announcement was made that an independent group of ten sponsors proposed to apply for permission to erect a group of stations throughout the country, all to be synchronized by wire connection and to be operated on one wavelength.

R. S. M. A. Non-Resident Membership

The Radio Service Managers' Association, 324 West 42nd Street, New York City has extended its full privileges and benefits to members who do not reside in New York. In addition to its service man's examination, employment bureaus and other advantages the association intends to establish a bureau for locating and restoring stolen radio sets.

RCA Boosts Spare Tubes Idea

"Good News," published in the interests of RCA Radiotrons urges the dealer to sell each customer at least one spare tube of each type in his set and to educate the customer to replace them himself when reception becomes faulty. Half the 37½ million tube renewal sales of 1929 were made over the counter and half by service men. "The day is coming when every customer will keep spare tubes on hand, but, before that day comes, customers must be taught to replace their worn out tubes without the aid of the service man."

German Radio Novelties

Among the novelties displayed at the annual Radio Exposition in Berlin was a gridless vacuum tube to be used as an audio amplifier. The control electrode consists of a metal coating which is sprayed on the outside of the tube. It is intended for use in cheap sets. An improved type of Vogt electrostatic speaker was also shown and claimed to give results rivalling those from electromagnetic and electrodynamic speakers.

Bankruptcy Petition Against Erla

Petition in bankruptcy has been filed against the Electrical Research Laboratories, Inc., Chicago, by concerns whose claims aggregate less than $30,000.

RCA Institutes Selects Supreme Test Equipment

A contract has been closed between the RCA Institutes, Inc., and the Supreme Instrument Corp., whereby the Supreme Model 90 Radio Set Analyzer will be offered to the students of the RCA Institutes as a part of their study courses. They are also equipped with the Supreme Model 400-B Diagnometer and the Supreme Shop Test Panel in each of their ten resident schools.

Cable Tube Merchandising Plan

Cable Radio Tube Corporation has instituted a new merchandising plan which is designed to increase volume of sales on Speed tubes. The plan calls for a substantial trade-in allowance by the dealer on old tubes when applied to the purchase of new Speed tubes; a small merchandise credit for the dealer on all trade-ins; and a 5% merchandise credit on the dealer's advertising costs. The consumer is given a trade-in allowance of 50 cents on tubes listed at $2.00 or less, of 75 cents on $2.25 tubes, of $1.00 on tubes listed at $2.50 to $3.50, of $1.50 on $4.00 and $4.50 tubes, of $2.50 on a $7.25 tube, of $3.00 on a $9.00 tube and of $4.00 on a $11.00 tube. The company credits the dealer with from 7½ to 90 cents, depending upon the type of tube and in addition pays 5c for every tube returned by the dealer. This enables the dealer to make an actual average of 50% mark-up. For advertising costs of $5,000 the dealer's credit is 6%, of $10,000 it is 7½%, and of $20,000 it is 10%. A Hickok tester is given as a premium on opening orders of $1,000 or more.

Kennedy Short-Wave Receiver

Colin B. Kennedy Corp., South Bend, Ind., has developed an a-c short-wave receiving unit that operates in conjunction with a standard long-wave receiver. Its circuit uses '24 tubes in one stage of untuned r-f, one tuned regenerative detector, and one tuned output oscillator. Its output is fed directly into the antenna circuit of any standard radio set, whose r-f stages act as the intermediate frequency amplifier stages of a superheterodyne receiver. The chassis is small and compact, tuning is not affected by body capacity and no "plug-in" coils are required.

Servel Refrigerator

Servel Sales, Inc., is about to introduce a new electric refrigerator which is well suited for sale by radio dealers. It solves the usual service problem by using a compact unit which one man can remove from the cabinet with only a screwdriver so that any necessary servicing can be done at the factory. It has no belts, pulleys, fans, gears, expansion or float valves. It is hermetically sealed. The price is low enough to avoid sales resistance.

Philco Sales Ahead

Philco distributors have been advised that the demand for Philco sets exceeds production facilities and that 150,000 back orders are on hand. Deliveries are being apportioned as fairly as possible. This condition applies not only to midget sets, but also to larger furniture models.

Capehart Features Automatic Phonograph and Radio

The Capehart Corp., Fort Wayne, Ind., is urging the sale of automatic phonograph-radio combinations as a means for stimulating the sale of records. The public will buy an instrument which does not require that records be changed by hand, and will also buy complete sets of records instead of single ones.

Midget Business in Los Angeles

The combined total production of midget receivers in Los Angeles now totals approximately 1800 daily. The demand continues with slight increase in volume over last month. Thirty-two manufacturers are now in the midget business in Los Angeles, some of them located in back-yard shops, garages and in backs of stores.

G. E. Radio Inspection Plan

General Electric Co. assures each purchaser of a G. E. radio one service call from the dealer. This is accomplished by means of a merchandise credit which the jobber gives the dealer upon the receipt of a certified inspection warrant signed by the purchaser. This warrant and a guarantee certificate is sent to the purchaser when he sends in the request form which is packed with each G. E. radio. Ninety days after installation the dealer's representative calls on the purchaser and gets the signed warrant if the customer is satisfied with the radio and the service he has received. After the merchandise credit has been issued the jobber cancels the warrant and returns it to the dealer for future sales promotion purposes.

Joint Sales of G. M. Radio and Frigidaire

R. J. Emmert, president General Motors Radio, and E. G. Biechler, president Frigidaire Corporation, announce a sales alliance which will enable many of their respective dealers to handle both lines. They are convinced that the radio dealer or the electric refrigerator dealer can take on the complementary line without altering his present set-up.

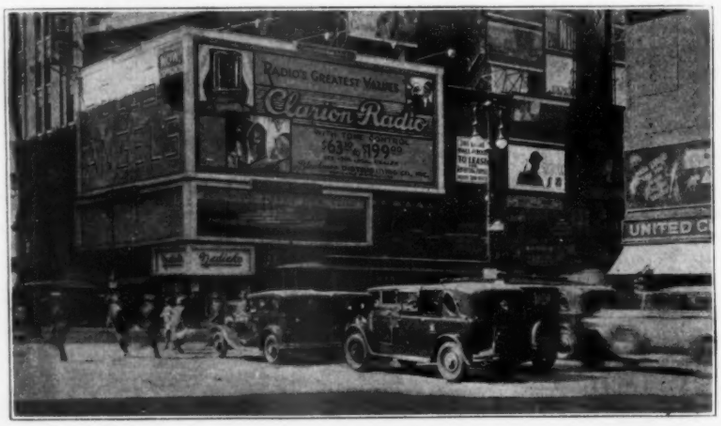
Remote Control of G. E. Radio

The new seven-tube General Electric Studio Lowboy may be provided with a remote control box connected to the set by means of a cable. This box is provided with six selector buttons, two buttons for lowering or raising the volume, and two buttons for turning the receiver on or off. These buttons operate a motor-driven tuner. The Studio Lowboy is especially designed as a "second" set in the home.

A Free Blimp Ride as an Extra Inducement

"Buy a radio and get a free ride in the Goodyear blimp Volunteer!" That's the message Pacific Wholesale, Ltd., Sparton distributors for Southern California, sent to the newspaper readers in its territory. And it is bringing results during a period of general depression and a season usually noted for its lack of radio business.

Walter M. Fagan, president of Pacific Wholesale, Ltd., provides any purchaser of a model 589 Sparton radio with a ticket entitling the bearer to a free half-hour ride in the Volunteer. The response has been far greater than even Fagan himself expected. Here was a new merchandising idea for the Sparton dealer and certainly a new premium for the Sparton purchaser. The success of Fagan's plan proves conclusively one fact: There is no such a thing as not being able to make bad business good!



The red-coated hunter in this painted board at Forty-second Street and Seventh Avenue, New York City, sounds the Clarion call to millions.

New *Radio* Equipment

Air-cell Batteries

After three years development in its research laboratories the National Carbon Co. announces production of the air-cell dry battery. This uses special carbon electrodes which absorb oxygen from the air instead of from oxygen bearing chemicals in the cell. It maintains constant voltage throughout a long life and is especially adapted as a filament supply to the new 2-volt tubes. It will supply *A* current to a 7-tube, 2-volt set for well over 1000 hours.

Atwater Kent Superheterodyne

Atwater Kent Mfg. Co. have added a superheterodyne, Model 72, to their new line of Golden Voice receivers. It

Atwater Kent Superheterodyne, Model 72

uses nine tubes, including three screen-grids and one rectifier and sells for $133, less tubes. It has a quick-vision dial, enlarged speaker, and tone control.

Amperite Line Voltage Control

Amperite Corporation,561 Broadway, New York City, announces a new type of line voltage control built in tube form. A single screw mounting makes it immediately applicable to any type of a-c radio set without altering the set. It is claimed to supply steady voltage when the line voltage fluctuates as much as 20 volts up or down.

Audiola Super

Audiola Radio Manufacturing Company, Chicago, is making a nine-tube superheterodyne, equipped with tone-control and local-distance switch, to sell for $107 complete with tubes.

Clarion Midget

Transformer Corporation of America announces the Clarion Junior

The Clarion Junior.

(Model 60) as a midget set to sell at $63.30 complete with tubes. It is unusually sensitive and selective, is free from oscillation, and is thoroughly shielded. It has an electrodynamic speaker with 8-inch cone and is equipped with phonograph jack and switch as well as tone control. It stands in a heavy cabinet 20 by 16 inches.

Kennedy Coronet

The latest addition to the line of radio sets made by the Colin B. Kennedy Corp. is the Coronet, an eight-tube set with electro-dynamic speaker in a cabinet 17½ by 16½ in. by 10 in., weighing 31 lbs. It employs screen-grid tubes in the two r-f, power detector and first resistance-coupled audio stage, with '45

Kennedy Coronet

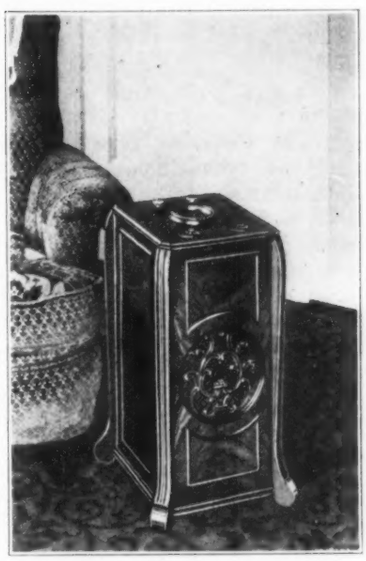
output tube and '80 rectifier. It is completely shielded, has tone control and electrolytic filter condenser.

Fastron Tubes

F. A. Schiller, Inc., 500 Chancellor Avenue, Irvington, N. Y., reports production on a complete line of Fastron radio, power, and television tubes.

New Sentinel Equipment

United Air Cleaner Corp., 9705 Cottage Grove Avenue, Chicago, manufacturers of Sentinel radio sets announce the Monotrola, the Duotrola and the Chromatrola. The Monotrola is an eight-tube superheterodyne with electrodynamic speaker, all housed in a beautiful portable cabinet which may be readily moved about the floor. The tuning controls are on top of the cabinet and aerial-ground connection is supplied through the same cable that gives power for operation. The Duotrola contains similar equipment in two cabinets, one portable and the other fixed. The portable cabinet, with tuning control on top



Sentinel Portrola

contains the r-f and first audio equipment and the fixed cabinet contains the power amplifier, speaker and a phonograph. The Chromatrola is a phono-radio combination with electrical phonograph recorder. The latter uses standard size blank records made of aluminum alloy and records either radio or local programs.

New "B" Battery for Auto Sets

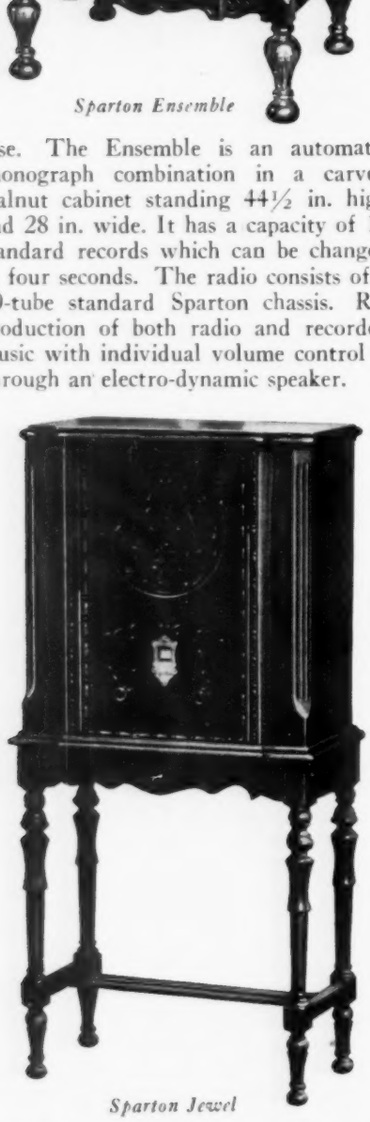
U. S. L. Battery Corp., Niagara Falls, N. Y., has perfected a new line of *B* batteries for use with automobile radio sets. It is designed to withstand road shocks and vibrations which might otherwise crack the sealing compound or break connections between cells. It is waterproofed to prevent moisture absorption under extreme conditions of temperature or humidity. Samples of the product are tested to withstand 1,000,000 bumps, 24-hour immersion in water, 24 hours at 20 degrees below zero and at 140 degrees F.

Three New Sparton Models

Sparks-Withington Co. have brought out three new models, the Ensemble (Model 235) selling for $280, the Jewell (Model 420) selling for $96.50, and the Junior (Model 410) selling for $56, the prices being less tubes in each

Sparton Ensemble

case. The Ensemble is an automatic phonograph combination in a carved walnut cabinet standing 44½ in. high and 28 in. wide. It has a capacity of 12 standard records which can be changed in four seconds. The radio consists of a 10-tube standard Sparton chassis. Reproduction of both radio and recorded music with individual volume control is through an electro-dynamic speaker.



Sparton Jewel

The Jewell employs two screen-grid tubes, one '80 and one '27 tube and two type 183 tubes for push-pull amplification. It is equipped with an electro-

Sparton Junior

dynamic speaker and an antenna compensating condenser, which permits the set to be adapted to any type of antenna system.

The Junior has the same chassis features, dynamic speaker, antenna compensator, etc., that makes a Sparton a Sparton.

New Fada Battery Set

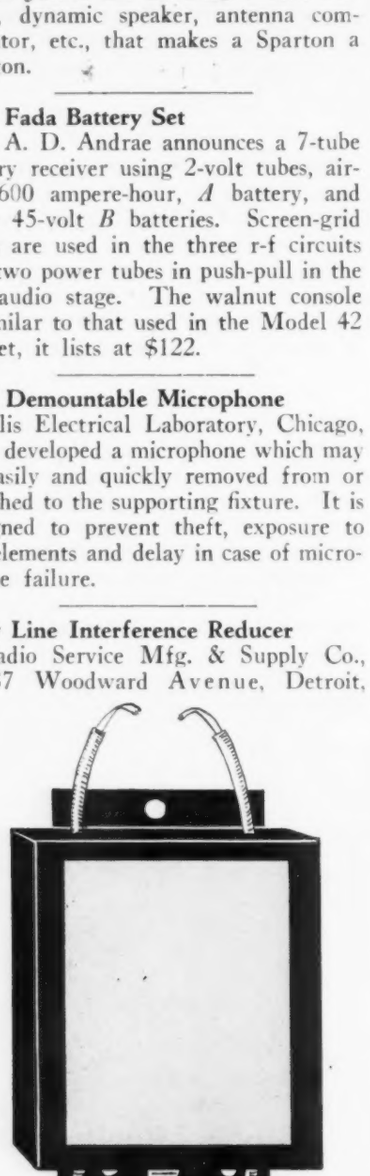
F. A. D. Andrae announces a 7-tube battery receiver using 2-volt tubes, aircell 600 ampere-hour, *A* battery, and three 45-volt *B* batteries. Screen-grid tubes are used in the three r-f circuits and two power tubes in push-pull in the last audio stage. The walnut console is similar to that used in the Model 42 a-c set, it lists at $122.

Ellis Demountable Microphone

Ellis Electrical Laboratory, Chicago, have developed a microphone which may be easily and quickly removed from or attached to the supporting fixture. It is designed to prevent theft, exposure to the elements and delay in case of microphone failure.

New Line Interference Reducer

Radio Service Mfg. & Supply Co., 10337 Woodward Avenue, Detroit, Mich., announces a fixed condenser which is especially designed to minimize power line interference. Its four terminals can be connected across the line leading to interference—producing devices; its fifth terminal is to a third plate which is claimed to aid the reduction of interference. It may be safely used with a 240-volt circuit.



Model 14 Radiette

1931 Radiette

Keller-Fuller Mfg. Co., Ltd., Los Angeles, Calif., announce a new model Radiette, No. 14, which uses 4 screen-grid tubes, a '45 and an '80. It has four tuned circuits, a band-pass filter, automatic tone adjustment, and unified control. The cabinet is finished in two-toned walnut and houses an electro-dynamic speaker. The price is $59.50 complete with tubes.

Pilot Makes Midget

The Pilot Radio and Tube Corp., Lawrence, Mass., is making a six-tube midget receiver in a walnut cabinet 17

Back View of Pilot Midget Receiver

by 8½ by 17 in. It has two stages of screen-grid r-f, screen-grid detector, '27 first audio and '45 second audio, with '80 rectifier. The field winding of the 6-in. dynamic speaker forms part of the filter system. It lists at $59.50 without tubes. The set is being sold through regular retail dealer outlets.

(Continued on Page 50)

LETTERS TO THE EDITOR

That $5000 Ante

Sir: Henry L. Williams' article on "Thousand Dollar Shoestrings" in September RADIO mentions $5000 as a proper figure for the minimum capital with which a radio dealer should conduct his business. As radio dealers, our net worth last year was $4200, and this year, after a period of severe depression is $3300. We were financing through a New York firm and met every payment promptly. Yet they will not discount our paper this year, saying that every account must have a net worth of at least $5000.

We believe that such a ruling is unsound and arbitrary, due to the fact that our low cost of doing business makes possible a fair profit on less capital than the finance company sets as a minimum. Furthermore we believe that the extent of credit from a finance company should be determined by an official of the company on the basis not only of the capital invested but also of the cost of doing business.

Furthermore instead of having only one standard plan for all dealers there should be several plans for different classes of dealers, depending upon their financial standing, experience and ability. After a dealer has once allied himself with a finance company he may find it difficult to change to local bank financing. So it seems to be no more than fair that the finance company continue to give the *same* support to the dealer *every* year providing that his leases have proven sound and that his obligations have been met promptly.

While a capital of $1000 to $2000 is admittedly inadequate for an independent dealer, it is possible to make a living from such small capital by securing a sub-agency from a large dealer who is well financed and wants an outlet in a promising suburb. Sets are given him on consignment and a 15-18 per cent commission on sales. In this way almost all of the small capital can be used as reserve.

There certainly is plently of opportunity for greater coöperation and better mutual understanding between *all* finance companies and the dealer. We are curious to know the outcome of the tendency to discourage the small dealer and to distribute through group outlets.

F. R. PRAY & Co.,
Boston, Mass.

From a Jobber to His Dealer

Sir: Yesterday afternoon I had one of these "depression" salesmen in my office. He was taking the times apart and putting them together so they would tick dollars, and I guess he talked hard for about an hour.

Junior (that's young Harry Moll) was outside, waiting to 'touch" his old man for $2, and of course Junior got a good earful of the conversation. Here's what I got from my offspring when the caller had left: "Dad, why didn't you grab that guy by the collar and the seat of the pants and throw him down stairs? He's poison, and he's poisoning you. Your face looks as if the sheriff had just nailed up the front door. You could have signed up a new dealer while that man was talking hard times."

And the boy was right. All the time we spend crying for the easy money of 1929 is time lost—and lost time goes down in red ink on our ledgers.

The difference between good times and bad times is only about 10 to 15 per cent; but we look at the figures so long and talk about them so much that they begin to look like 60 per cent. And they *do* reach 60 per cent, and even higher, if we do nothing but *talk it over.*

The ..... radio is the greatest money-maker in front rank radio, because it is built the way your customers want it built; it does what they want a radio to do, and it sells at a price they would gladly pay. But if it was a hundred times better than it is, and if it sold for only $10 a unit, it would never in the world sell itself!

Talking about the 'times" does not sell radios. There is no money in any kind of talk, unless it is sales talk, delivered directly into the ear of a hot prospect—in your store or in that prospect's home.

Talk "depression" only three minutes a day. Talk radio sets eight hours a day, and you'll lead your territory in sales. Why not try it?

Denver, Colo. HARRY MOLL.

BOOK REVIEWS

"THE ELEMENTARY PRINCIPLES OF WIRELESS TELEGRAPHY AND TELEPHONY," by R. D. Bangay, third edition, 268 pages; revised by O. F. Brown, B. Sc.; published by Iliffe & Sons, Ltd., Dorset House, Tudor Street, London, E.C.4. Price 10/6d net, by Post 11/—1.

This is primarily a textbook for the student of radio fundamentals and the theory of receiving and transmitting circuit design. The first twelve chapters have been changed but slightly, while the remaining fifteen are the work of the reviser.

The first six chapters take up electricity and magnetism, the dynamo, the transformer, the principles of wave motion, properties and production of waves. They are written in a thorough but simple style, with enough mechanical analogies to make the subject interesting to the student without previous study. The next six chapters deal with the production of high frequency oscillations, fundamental circuits, with an excellent treatise on aerials and masts.

The remaining chapters discuss the theory of alternating currents, vacuum tubes or valves, reception and transmission, frequency stabilization, power supply systems, loudspeakers, short waves and direction finding. Some practical information is given as well as a thorough treatise on the fundamentals.

NEW DISTRIBUTORS

Ware

The Ware Manufacturing Corporation announces the appointment of Musical Products Distributing Company, Inc., of 22 West Nineteenth Street, New York City, as the exclusive distributors of the Ware Bantam receiver for all the metropolitan area of New York with the exception of northern New Jersey.

Grebe

A. H. Grebe & Co., Richmond Hill, N. Y., have appointed Vreeland Radio Corp., Denver, Colo., and Riga-Gravlin Co., Springfield, Mass., as distributors. This company reports that present orders are on par with last year and anticipates a 25 per cent increase in business during the next three months.

Stromberg-Carlson

M. C. Schoenly, Inc., of Dallas, Texas, has been appointed southwestern representative for the Stromberg-Carlson Telephone Manufacturing Company of Rochester, N. Y., with offices in the Allen Building.

Story & Clark

Boetticher & Kellogg Co. have been appointed exclusive distributors of Story & Clark radio in the Evansville and Indianapolis, Ind., territory.

Lyric

Andrew Murphy & Son, Omaha, have been appointed distributors of Lyric radio for Nebraska and Western Iowa.

CeCo

CeCo Manufacturing Company has opened another wholly owned distributing branch at Cincinnati, Ohio, under the name of the CeCo Radio Tube Company of Ohio. Other such branches are located at New York, Boston, Providence, Pittsburgh, Philadelphia and Chicago.

NEW RADIO CATALOGS

A General Parts Catalog from Silver-Marshall, Inc., Chicago, Ill., illustrates and describes the complete line of sets, kits and parts made by this firm. Listings include screen-grid superheterodyne receivers and tuners for broadcast wave lengths, receivers and converters for short waves, chokes, coils, condensers, resistors, r-f, a-f and power transformers, power amplifiers, speakers, wire and cable.

Catalog M-50 from Miles Reproducer Corp., 45 West Seventeenth Street, New York City, illustrates and describes the complete line of Miles microphones, accessories, exponential trumpets and horns.

American Transformer Company, Newark, N. J., has issued several new bulletins regarding its products. No. 1050 is devoted to Amertran audio transformers, of which there are 34 standard models for various amplifier requirements. High-permeability alloy is used in the core laminations in all cases. No. 1072 describes the Amertran type P-77 power supply unit which uses two type 66 mercury vapor tubes to furnish humless voltage to equipment using 205D tubes. No. 1079 describes Amertran Series 80 amplifiers with outputs of 4½ and 12 watts.

PERSONAL MENTION

Howard C. Briggs, formerly with the radio division of the Kellogg Switchboard and Supply Company, has become assistant general sales manager of Silver-Marshall, Inc.

Louis Gruen has been made representative for Sentinel radio, with headquarters at 1800 Broadway, San Francisco, Calif.

A. H. Smith, formerly sales manager for H. A. Bolet, New York City, has been made assistant to the sales manager of the Insuline Corporation of America.

M. Caldwell has been appointed general sales manager of the Dubilier Condenser Corporation, succeeding N. S. Tobey, who has become executive vice-president of the company.

George Kohlenberger, formerly associated with the Oakland, Calif., branch of United Motors Service, has become manager of radio sales and service for the company's Delco automotive radio.

Henry C. Engel, formerly of the Chas. Freshman Corp., has become comptroller of purchases at the Muskegon, Mich., plant of the Brunswick Radio Corporation.

Otto May, Pacific Coast manager RCA-Victor Co., has been elected president of the Pacific Radio Trade Association and L. B. Quimby, of Oakland, Calif., vice-president.

J. B. Price has succeded Herbert H. Frost, resigned, as eastern manager of the Utah Radio Products Corporation of Chicago.

Don M. Compton, formerly vice-president and general manager of the U. S. Radio and Television Company, has become general manager of the Grigsby-Grunow Company of Chicago.

Harry Kalker, sales manager International Resistance Company, manufacturers of Durham metallized resistors, has been visiting Pacific Coast midget set manufacturers.

F. E. Smolek has been made manager of the Service Department of Zenith Radio Corporation, Chicago, succeeding Dr. F. A. Rafferty, who has joined the Zenith merchandising staff in a selling and technical capacity.

R. G. Brownfield, of the RCA Radiotron Company, has been transferred from headquarters in Harrison, N. J., to the southern district, with headquarters in Atlanta, Georgia, where he will operate as an RCA Radiotron specialist under Richard A. Graver, district manager.

Sydney Schwartz has been made manager of the Brunswick Radio Corporation Sales Promotion Division. He was formerly manager of the Southern District. He plans a complete sales education and dealer development program, with promotion of all retail salesmen to "merchandising assistants."

The Pilot Radio and Tube Corporation, whose factory and main offices are at Lawrence, Mass., has established a New York office at 525 Broadway, with Charles Gilbert in charge. The old plant at 323 Berry Street, Brooklyn, has been closed.

The Western Sales Company, Inc., Commonwealth Building, Denver, Colo., is seeking representation of radio and electrical manufacturers.

ASSOCIATION NEWS

The National Federation of Radio Associations is preparing a new code of suggested business practices for radio retailers. Last year 20,000 copies of such a code were distributed. The new code will recognize recent developments and changes in retailing methods. The association is also compiling a booklet on the organization of an interference department in a community.

The Radio Wholesalers' Association is making a survey of products which are offered for sale through radio wholesalers to dealers who specialize on radio sets. This survey is under the direction of the Special Supplementary Line Committee, of which Robert Himmel is chairman. This service will assist members in determining whether it is advisable to add a certain non-radio product to their present line of radio merchandise. It is planned to bring it to the attention of the home talking picture industry, home entertainment features, musical devices, sporting goods houses, electrical side lines and other allied trade bodies. The inquiry form used in the survey covers details not only about the product, but also about the sincerity, policies and financial standing of the maker.

President Metcalf of the RMA has issued a call for a meeting of its board of directors at Cleveland, O., on Tuesday, November 18, at the Hotel Cleveland. Among many important industry problems to be considered at the Cleveland meeting is that regarding the 1931 trade show. A meeting of the directors had been planned at Chicago during the Chicago radio show, but so many directors found it impossible to be present at Chicago that the RMA board meeting was postponed until November 18. The postponement has afforded opportunity for further exchange of views between manufacturers regarding the 1931 show.

The meeting of the RMA directors at Cleveland will be coincident with the annual membership meeting of the National Association of Broadcasters, and there will be joint committee consideration by the manufacturers and broadcasters of many affairs in which there is mutual interest, one of these being the pending copyright bill in Congress on which joint committees of the RMA and NAB have been working.

Many RMA committees are engaged on varied manufacturing and merchandising problems. Several committees met at Chicago last week and will present reports to the RMA board of directors at Cleveland. Among these were the merchandising committee, headed by R. W. Jackson of the Brunswick Radio Corporation of New York, the credit committee, headed by Leslie F. Muter of Chicago, and the traffic committee, headed by Clarke Coit of Chicago. There also were meetings of two manufacturers' groups in which their individual problems were considered. Standardization of cabinet manufacture was discussed by the cabinet manufacturers' group, headed by N. P. Bloom of the Adler Manufacturing Company of Louisville, and engineering problems incident to amplifier manufacture was considered by A. C. Kleckner of the Webster Electric Company of Racine, Wis.

New Radio Equipment

(Continued from Page 48)

Clarostat Tone Control

Clarostat Mfg. Co., Brooklyn, N. Y. has developed a simple device which is applicable for controlling the tone of

Clarostat Tone Control

any radio set. It consists of a variable resistor whose connections are attached through flexible leads and disc connectors to the prongs of the power tubes in the set. A knob provides any desired degree of sharpness or mellowness.

Audak Polyphase Pick-up

This phonograph pick-up unit is equipped with a tone control device whereby it is possible to place the emphasis upon either the low, the middle, or the upper ranges. It can also be used to record speech and music on pre-grooved records.

Improved Arcturus Screen-Grid Tube

Arcturus Radio Tube Co., Newark, N. J. is employing a new patented method of filament insulation in its screen-grid tubes. This greatly minimizes the hum and yet retains the 7-second action feature which is characteristic of Arcturus tubes.

Radiola Easy Chair Receiver

Radiola Division of the RCA-Victor Corporation has introduced a compact screen-grid r-f set which stands less than three feet high and occupies small floor space. This Model 48 lists at $112.50, less tubes. It has a horizontal dial, electro-dynamic speaker, and one-knob operation of two volume control.

Ware Bantam

Ware Manufacturing Corporation, Trenton, N. J., is producing a six-tube midget set under the name of the Ware Bantam. It employs three '24, one '27, one '45 and one '80 tube, and contains electrodynamic speaker in a 17½x15¾x7-inch cabinet.

ASTOUNDINGLY LARGE MARKET FOR B-H RECTIFYING TUBES GO AFTER IT!

Always keep a carton of Eveready B-H Raytheons on display

EVEREADY RAYTHEON B-H

MORE than 100 makes of "B" power units call for the B-H tube as standard. Most units have been particularly designed for the B-H. When replacements are necessary your customers want B-H tubes. Millions have been sold in the past few years. Cultivate this replacement market.

Eveready Raytheon B-H Tubes come in handy four-tube cartons. Always have a carton on display, where replacement customers can see it easily.

* * *

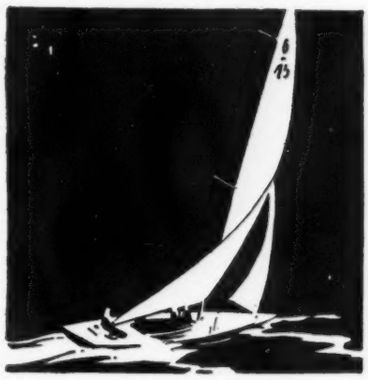
The Eveready Hour, radio's oldest commercial feature, is broadcast every Tuesday evening at nine (New York time) from WEAF over a nation-wide N. B. C. network of 27 stations.

NATIONAL CARBON CO., Inc.
General Offices: New York, N. Y.
Branches: Chicago Kansas City New York San Francisco
Unit of Union Carbide and Carbon Corporation

EVEREADY RAYTHEON

Trade-marks

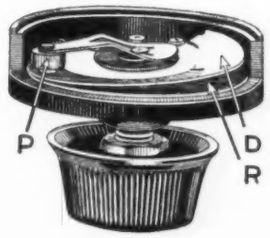
Smooth Sailing DEMANDS *Control*



REGATTAS are won when Control is at the Helm. Every carefree gust of wind must be controlled . . . every sail bellying properly, working the sloop smoothly, surely around the final buoy and down the last leg, the winner. In millions of homes radio skippers are cruising around the dials with CENTRALAB Controls at the helmsman's hand.

With Centralab Control at the helm, there is always smooth, noiseless reception. Be Sure it's a CENTRALAB Control.

This shows the exclusive rocking disc construction of Centralab volume control. "R" is the resistance. Contact disc "D" has only a rocking action on the resistance. Pressure arm "P" together with shaft and bushing is fully insulated.



Send 25c to Dept. 103-A for Special Bulletin, "Volume Control Guide."

Centralab

CENTRAL RADIO LABORATORIES

Dept. 103-A 14 Keefe Avenue Milwaukee, Wis.

RIDING SIX HORSES

(Continued from Page 23)

You can't sell all the sets that are sold in your town, anyway; sell the one you think is best, and if you've got a good one and really know you have, you won't starve to death—unless the furniture stores change their present policy and start giving radios away free to all comers.

Sticking to one set is the best way, too, of avoiding the danger of the smaller dealer spreading himself out too thin. It's too expensive to try to sell everybody everything. At any rate, it's a matter of capital. Just as I have expressed the opinion in previous articles that the dealer should hold his business strictly within the limits of his capital, so I would point out here that the best way to do this is to limit your lines of sets to that point at which your funds are employed the most profitably. Carry more of your own paper and sell fewer sets. Don't break your neck to build free aerials, sink your profits in trade-ins, cut your prices and run yourself to death to hand out all the sets in creation to prospects who could perhaps be sold just as well on the I've-got-the-best-set-in-the-world-and-I-dare-you-to-try-any-other system, or who otherwise should be passed up.

THE radio manufacturers are strongly in favor of the dealers selling one make—their make. The manufacturers' representatives can bring forth strong arguments and sometimes are adopting pretty coercive measures that are very irritating to the independent dealer. The agents of the manufacturers are fond of pointing out that the automobile makers franchise only dealers who handle exclusively their particular make of car. They infer that the radio retailer should likewise specialize on the product of one manufacturer.

It is worth replying, however, that the automobile manufacturers strictly limit their distributors and seldom have more than three or four dealers in even the largest cities, whereas the radio manufacturers franchise six stores in the same block and leave them to claw at one another like a bunch of wildcats hung by their tails over a clothesline. I think this is one of the most unfair and evil practices that exists today in the radio business.

If the radio manufacturer wants the retail dealer to work wholeheartedly on his one set, that manufacturer should certainly not franchise any other dealer anywhere near that loyal fellow who sticks with that single line. Yet in the case of the make that I have called Imperator—and it's one of the best—I know of a straight Imperator dealer who has six Imperator-and-mixed set dealers within three blocks of him. And as for Tin-Loaves—they are offered for sale in every kind of retail establishment from hardware dealers to—well, to everything but grocers and bakers. Fat chance a dealer has to look dignified pushing one of those lines. Yet such lines are the best and biggest selling ones; the only ones perhaps the dealer can put his heart behind selling. It's up to the manufacturers to give the single-set dealers a fairer break.

PROFIT PROMOTION

(Continued from Page 28)

In no case, however, are the estimates expected to be in the best possible condition when the plan is first outlined. Indeed, the figures may be changed a number of times before the fundamental profit-making plan is accepted as presenting the best goal toward which to strive. The figures must be adjusted to make the "parts" work together most effectively.

How the Adjusting Is Done

WHEN the outlined plan shows that an unsatisfactory volume of profit would be produced by the estimated operations, we simply study the figures to determine where the necessary changes should and can be made.

It may well be that no opportunity for betterment will be discovered immediately, though we all realize that no business ever makes a perfect score. There usually are a number of opportunities for increasing the profit volume, and quite aside from the ever-to-be-considered possibility of increasing the sales volume.

The big managerial job lies in finding those opportunities and taking advantage of them. The beginning of that job necessarily involves a careful study of the profit-making process as applied to the individual.

That is why a carefully constructed and earnestly studied profit-making plan similar to the one presented in this lesson, has much greater profit-increasing possibilities than are readily recognized on first thought. As you study the plan, so will it work for you.

EDITOR'S NOTE: Mr. Koch's next lesson for RADIO's course in Profit Promotion will take up this important subject: "What the Radio Retailer can do with Sales Quotas." Are you saving every issue so you can review these informative lessons from time to time?

New Weston

MODEL 565

The Complete Test Set for Radio Servicing

THE new Weston Model 565 is the most complete instrument designed for radio service work. It makes every required test on every modern set, and checks every type A.C., D.C., Pentode, and Rectifier tubes. Besides, it is made in the typical Weston fashion with the refinements in design, ruggedness in construction, precision in manufacture, and dependability in performance such as only Weston can build with its years of experience as manufacturers of the world's highest quality electrical measuring instruments.

In this one instrument, the Weston Model 565, you have a complete radio service laboratory—Set Tester, Tube Checker, Oscillator, Ohmmeter, A.C. Ammeter, D.C. Milliammeter, A.C. and D.C. Voltmeter, with more and wider ranges than ever before.

The new Weston Model 565 set and tube service unit with its compact construction and complete testing facilities is designed to save you time and money. It operates similarly to the popular Weston Model 547 Set Tester—quickly, conveniently, accurately, and with the widely known Weston dependability.

So valuable is this new Weston Model 565 that every radio dealer and service man who builds his business prestige on quality service work cannot afford to be without it.

Write today for illustrated folder which gives complete information

PACIFIC COAST REPRESENTATIVES

Graybar Electric Co., Inc.
84 Marion St.
Seattle, Wash.

A. A. Barbara
Los Angeles, Calif.

J. H. Southard
San Francisco, Calif.

Repair Service Laboratory
682 Mission Street
San Francisco, Calif.

Weston
PIONEERS SINCE 1888
INSTRUMENTS

WESTON ELECTRICAL INSTRUMENT CORPORATION
600 Frelinghuysen Ave. Newark, N. J.

1906 1931

Sell Tubes--not tube troubles!

YOU can handle radio tubes with handsome profit, quick turnover, and sound investment in future good will. Or you can sell tube troubles with loss of immediate profits and impaired good will. Your choice determines the issue.

So why not sell good tubes—not tube troubles? If you are a dealer, you cannot afford to jeopardize your trade by selling uncertain radio tubes. If you are a service man, you cannot afford to jeopardize your reputation by using uncertain radio tubes. Tube troubles are costly at any price.

Fortunately, tubes are no longer a gamble. You can be sure of 1930 tubes. You can be sure of tubes produced during the past month or two, and not a year or two ago. You can be sure of tubes that incorporate the latest improvements and refinements in the vacuum tube art.

Play safe! Recommend and use DeForest Audions—the oldest tubes on the basis of history and prestige, the newest and latest on the basis of improvements and refinements.

DeForest Audions are standard equipment in Crosley and Brunswick sets.

Let us tell you more about 1930 radio tubes and what they mean in your work. And if you have any engineering or servicing problems, do not hesitate to place them before our Engineering Department.

REMEMBER, THERE IS NO SUBSTITUTE FOR TWENTY-FIVE YEARS' EXPERIENCE

de Forest (AUDIONS) RADIO TUBES

DE FOREST RADIO COMPANY, Passaic, New Jersey

Export Department: 304 E. 45th Street New York City, N. Y., U. S. A.

Size 13" x 18" x 8"

Sell Your Own Brand MIDGET RADIO

"Screen Grid"---Dynamic Speaker

Smart merchandisers will put their sales efforts behind the so-called "Midget" this season—there's a reason. Those that are real smart are adding to their line a private brand of the better kind and one that's out of the cheap price class.

We specialize in serving the real smart with complete sets (either under Premier trade name "HOME-PAL," or your own private brand), or chassis only—Six tubes (3 Screen Grid, 1 No. 227, 1 No. 245, and 1 No. 280). Rola, Magnavox or Oxford Dynamic Speaker.

Write today for details and prices

PREMIER ELECTRIC COMPANY

3803 Ravenswood Avenue *Established 1905* Chicago, Illinois, U. S. A.

SOME TIPS ON BOOKKEEPING

(Continued from Page 34)

First, we can make the entry on the income side of our cash book; debiting the amount in the miscellaneous column and marking it "General Expense — Bad Debts." And of course credit customers' accounts. Or we can write a check to cash; make the entry for it on the expense side by of course crediting cash paid out, and debiting the amount in the general expense column and marking it "Bad Debts." Then we run the check through our income side, debiting all cash received and crediting customers' accounts. While the latter method requires two entries instead of one as does the former, I think the latter is best since it puts the bad debt general expense item in the general expense column on the expense side where it is easy to find when we go to make up a list of items at the end of the year. However it is entirely proper to handle it either way.

One thing that seems to bother many dealers is increasing their investment account. If you are putting more money into your business merely debit the amount under all cash received and credit in the miscellaneous column, marking it "Investment." Then at the end of the month when the miscellaneous columns are segregated the amount will automatically come out and go to the investment account on the credit side of the ledger.

We left our ledger with the profit and loss sheet showing a debit figure of $22.90, which as explained was a LOSS. Now suppose that when you next get your profit and loss figure, this $22.90 has changed to $52.90, still on the debit side. Your loss for the period would therefore be the difference between $52.90 and $22.90, or $30.00. Then suppose when you took the next P and L the balance was $10.90, but still on the debit side; for that period you made $40.00, because the new P and L figure of $10.90 is $40 less than it was previously at the beginning of the period. Let us suppose that on the next one the figure is $142.00 but on the CREDIT side. How much did we make for that period? Well, at the beginning of the period we were $10.90 to the bad on the debit side; but now we are $142.00 to the good on the credit side; so of course our profit for the period was $10.90 plus $142.00, or $152.90. And so on.

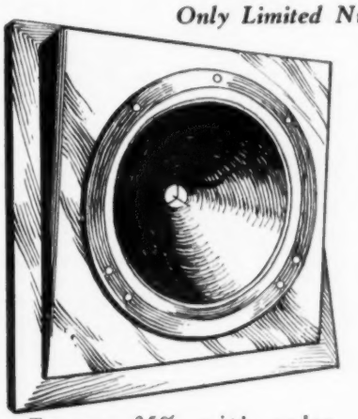
You of course understand that a trial balance is taken at the end of each month, and the correctness of our work proven; but the profit and loss amount remains the same for all trial balances until we post through our inventory figures—say each three months.

Radio Business Improved

"The radio industry is rapidly assuming its normal stride. The business tide has decidedly turned, and the flood of liquidations that began last fall has about run its course. With the seasonal upward trend, both of employment and of the public payroll now under way, the purchasing power of the public will be greatly increased and there will be money available for radio expenditure which would not have been spent while thoughts of lessened incomes were in the people's minds. There has been a decided improvement in the design and operation of the new 1930 model radio sets, and the radio public may purchase such merchandise without fear of its early obsolescence." Thus states Harold J. Wrape, chairman of the advisory council of the National Federation of Radio Associations.

Regarding broadcasting, Mr. Wrape states: "Broadcasting programs have reached a pinnacle of perfection never heretofore dreamed of. At all times there is now available some splendid form of radio entertainment to every home in America, some form of broadcasting program that will be pleasing to the most exacting radio listener. The home without a modern radio set is missing the greatest opportunity available for splendid, wholesome, worth-while entertainment and an opportunity to secure the latest and best information on sports, finances and education."

Several RMA committees also are at work on several tube manufacturing problems. The committee on new tubes, headed by Mr. Roger Wise of the Sylvania Products Company of Emporium, Pa., met at New York on October 17, and on October 30, in New York, there was a meeting of the tube standard sub-committee, headed by Mr. George L. Rishell.



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Remittance Must Accompany All Ads

Radioads for the December Issue Should Reach Us by December 1st

BUSINESS OPPORTUNITIES

STARTLING INVENTION! SCREW-HOLDING SCREWDRIVERS! Remove, insert screws inaccessible places! Factories, garages, electricians, mechanics buy on sight! Sells $1.50; exclusive territory. FREE trial! Toolco, 1592 Water St., Boston.

MAGNAVOX R-3, $15. Crosley Portable 50P, $7. Both like new. F. W. Metz, Romeo, Michigan.

RCA 105 Speaker in RCA console cabinet. Uses UX250 Tube. Cost $350.00. Sell for $75.00 (less tubes). H. W. Dickow, 1486 Portola Drive, San Francisco, Calif.

BARGAINS! BARGAINS! BARGAINS! Our new "Bargain Bulletin" contains many items at prices that will astound you. Send for it today. It will save you money! Harrison Radio Co., Dept. P, 189 Frankin St., New York City.

AMATEURS-EXPERIMENTERS-BUILDERS—We serve over 4000 IRE, ARRL, etc., experimenters and "nuts." Full discounts. $50,000.00 stock approved parts—no sets. Over four pounds, catalog, circuits, data, prepaid, 50c. Weekly bulletins (new items, results of experiments, etc), 20 weeks, $1.00. Sample experiments "Over the Soldering Iron" magazine, 25c. Transmitting data, price list, etc., 25c. Kladag Radio Laboratories, established 1920, Kent, Ohio.

SERVICE MEN ATTENTION—Speakers rewound, magnetized, repaired, $2.00 to $2.75. Complete Power Pack Service—Transformers rewound. Condenser blocks repaired, resistors duplicated. Guaranteed. Clark Bros. Radio Co., Albia, Iowa.

SCREW-HOLDING SCREWDRIVERS! Remove, insert screws from inaccessible places! Factories, garages, electricians, mechanics, auto, radio owners buy on sight! Exclusive territory. Free Trial! Manufacturer, 1709 Winthrop Bldg., Boston.

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COMPLETE POWER-PACK SERVICE—Transformers rewound, Condenser blocks repaired. Resistors repaired or duplicated. Specially equipped shop. Work guaranteed. Clark Brothers Radio Co., Albia, Iowa.

Power pack and radio repair service for dealers and service-men. All work guaranteed. Lowest prices. Quick service. Best equipped shop in Middle West.

Write for price list on repair work, replacement condenser blocks, and power transformers. Atwater Kent 37 Condenser Blocks $6.00 postpaid.
Grant Radio Laboratories, 6521 South Halsted Street, Chicago, Ill.

LOG BOOK

Radex is the master log book that shows where to dial for every station in North America. Always up-to-date. Crammed with brief, pithy articles and studio sidelights. Users state there's nothing else like it.

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Large size, printed in two colors, and shows location of every broadcasting station in North America. Index gives Call Letters, Power, Frequency, and key to location on map. Simple method of measuring distances.

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FRESHMAN - FREED - EARL FREED - EISEMANN

Freshman (G) audio transformer	$ .42
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Freshman N 60S No. 4528 condenser block	3.25
Freshman N 60S No. 4832 Power Transformer	4.50
Freshman Q. 8½ M.F. Condenser (filter)	2.25
Freshman Q. and 3 Q. Power Transformer and Choke No. 4421	3.25
Freshman QD Power Trans. and Choke No. 4827	5.50
Freshman A.B.C. Eliminator Cond. Block	1.25
Freshman G 60S Filament Transformer	1.75
Freshman G 60S Plate Transformer	2.25
Freshman G 60S Audio Transformer	.42
Freshman N. & G 60S voltage divider	.60
Freshman double choke for G 60S	1.15
Freed-Eisemann 80 & 85 Volume Controls	.27
Freed-Eisemann 85 Condenser Block	1.35
Freed-Eisemann 80 & 85 Power Transformer	4.50
Freed-Eisemann 70 Condenser Block	1.35
Freed-Eisemann 80 Condenser Block	1.25
Freed Model 55, 56, 78, 79 and 95 small and large knobs	.09
Freed Model 78, 79, 95 Power Transf.	4.65
Earl 31, 32 & 41 Power Transformers	4.65
Earl 22 and 24, Freed 55 and 56 Power Transformer	3.10
Earl 22, 24, 31, 32 and 41, Freed 55, 56, 78, 79 and 95, Freed-Eisemann 57, 60 and 80 double 30 Henry chokes	1.15
Earl 31, 32 & 41, Freed 78, 79 & 95 double Centralab volume control 50,000 ohm	.58
Earl 22 & 24, Freed 55 & 56 double Centralab vol. control 250,000 ohm	.50
Earl 22, 24, 31 & 32, Freed 55, 56 & 78, Freed-E. 8, 9, 11, 57, 60, 66 friction drives	.15
Grebe 1 M.F. 300 volt condenser	.20
Grebe ½ M.F. 300-volt Condenser	.12
Grebe Super Audio Transformer	1.25
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Grebe 125 mil. double chokes	1.65
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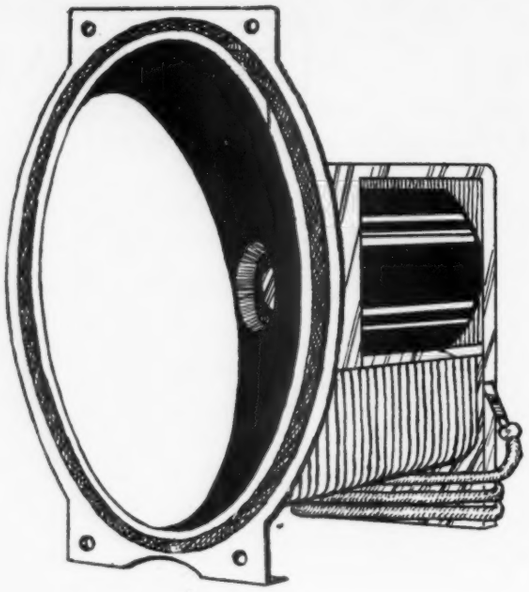
R.C.A. Model 17-18 & 33 Power Transformer	3.25
R.C.A. Double 30 Henry Choke	.95
R.C.A. No. 18 Audio Transformer	.50
R.C.A. & A.K. line toggle switches	.10
Wire wound spaghetti covered grid suppressors 500, 750 & 1000 ohm doz.	.60
B. Eliminator transformer for replacement in any B. eliminator using 280 rectifier tubes	.98
Replacement audio transformer	.19
High voltage, 2 watt, metalized resistors 1000-15—4700 ohms, a dozen	1.50
Ward Leonard tapped wire wound resistors, 12,300-5, 135-10,000 and 7,900 ohms, a dozen	2.10
Eby Bakelite binding post marking Long Ant.-Gd-Speaker, a dozen	.40
Four gang Temple .00035 condenser	1.25
Carbon Pigtail Resistors in values of 130, 375, 500, 2000, 10,000, 20,000, 25,000, 50,000, 70,000, 100,000, 250,000 ohms, a dozen	1.00
2 meg. metalized grid leaks, a dozen	1.00
Eight-foot phone cards	.16

TERMS: 20% with order, balance C.O.D. on orders over $5.00.

Freed Radio Sales and Service Co.

16 Hudson Street New York City



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$4.50 EACH

Regular Price $32.50

UNUSED Zenith 90-volt electro-dynamic speakers in original factory cartons, each speaker guaranteed to be exactly as represented. Field resistance 2,500 ohms. Especially adaptable for use in rebuilding radio receivers now equipped with inferior speakers and also for auditorium and theater use. The original Zenith replacement speaker unit, most rugged in design and so arranged as to be mounted either to panel or on baseboard. 400 of these speakers are in stock for immediate sale in any quantity. Each $4.50. If you are interested in large quantities, write for prices. With each speaker is included a push-pull output transformer for '45 and '50 type tubes. Flexible cord, two feet long, included for connections to set.

SHIPMENTS

F. O. B. San Francisco. C. O. D. shipments must be accompanied by 50% of purchase price. Can also be sent by parcel post. Weight 12 pounds, packed.

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RADIO
REG. U. S. PAT. OFF.
THE NATIONAL TRADE MAGAZINE

SERVICE MAN'S SECTION

SENT TO ALL SUBSCRIBERS TO "RADIO" AS PART OF YOUR SUBSCRIPTION

The Radio Industry, *the* Public, Interference, *and* Public Utilities*

By G. R. WALTERS
Radio and Music Trades Association of Southern California

TO EVEN the most casual observer it must be apparent that radio has become a part of the every-day lives of the great majority. Their particular radio receiver represents, to them, a definite financial investment in entertainment.

Every instrument placed in operation creates a divided responsibility for its continuous operation. This responsibility is greatly misunderstood. To distribute it is no small job.

In presenting this paper for your consideration, I ask you to bear in mind that we are pioneering. At the present time there are no standards and but few precedents to guide us.

This meeting and this association are decidedly forward steps. It is to be hoped that this body may establish standards and precedents to serve, at least, as basic principles upon which other states and other less fortunate communities and utilities may work.

I believe you will agree that radio has created a problem of increasing magnitude; but interference, like any other problem, can be and should be dealt with to the satisfaction of all concerned if we are industrious enough and sufficiently far-sighted to search for facts and courageous enough to face them.

Let us take up first the subject of radio broadcast receivers.

There appears to be a marked tendency toward greater power and increased sensitivity. Several manufacturers have recently been licensed to use the superheterodyne circuit which has heretofore been an exclusive RCA privilege. Opinions differ as to the significance of this. Many believe this is the forerunner of entirely new receivers.

Several of these creations have been built to operate on a field strength of one-quarter of one microvolt per meter to produce a fifty-milliwatt output as against a previous sensitivity response of ten microvolts per meter.

This, in my opinion, means that some of the newer merchandise reaches down into unheard-of noise levels for commercial receivers.

While there is a growing tendency towards shielding, there are many sets on the market either unshielded, or partly so.

Regardless of the care used in installation an unshielded chassis provides sufficient local pickup to nullify the benefits of the most careful work of installers. This condition casts discredit on shielded lead-ins, and is discouraging to those who subscribe to better installation of the shielded type.

I would suggest that this body make strong recommendation to the RMA on the subject of shielding, and that we prepare a list of sets, efficiently shielded, and not, for the information and guidance of the members of this body.

Installations

WHILE every other department of the radio industry has steadily progressed, the all-important matter of installations has gone backward.

Increased sensitivity of receivers, and competition have increased a somewhat critical, but not hopeless, situation. Coupling between antennas, antenna lead-ins, and house wiring have led to the fallacious belief that ten to forty feet of wire constitutes an efficient antenna.

When lines are free from interference, the performance of a receiver may justify this belief, but when interference is present, all parties concerned are in needless trouble.

The radio public, as a whole, is ignorant of the necessity for good installations. No understandable treatise on this subject has ever been published.

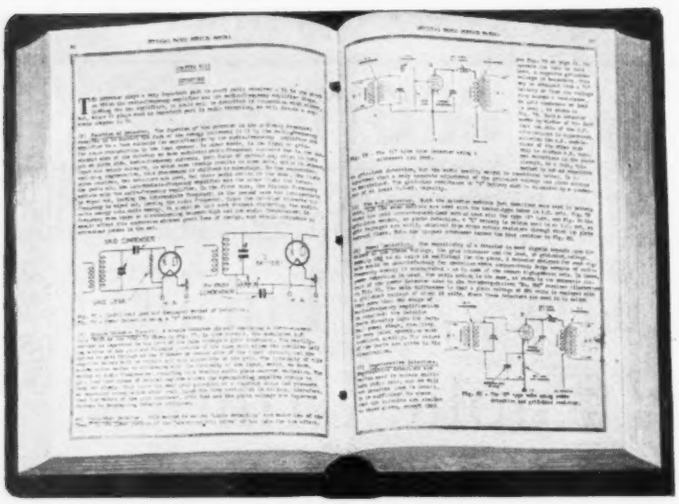
I believe the public is interested, and would be responsive, if properly informed. As proof of this last statement, may I state that one single broadcast over KFI on the subject of better installations, brought 1825 requests for our pamphlet on shielded lead-ins and filters. I would recommend that this body endorse a flexible standard of installation, to the end that when a preliminary investigation discloses the fact that a radio receiver is improperly or inefficiently installed, we shall not be obligated to the expenditure of time and money to correct conditions resulting from, or aggravated by, poor installations.

It is possible to secure a Coast hookup for educational purposes in the matter of radio interference and installations. Twelve fifteen-minute talks on KFI have produced the most gratifying results in Southern California. With the consent of the Pacific Radio Trades Association, and, if agreeable to this body, we shall proceed to negotiate for a Coast hookup, revamp the talks already given and

* Paper presented at October 28th meeting, California Radio Interference Association.

"Official
RADIO SERVICE MANUAL

and Complete Directory of all Commercial Wiring Diagrams



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HUGO GERNSBACK, *Editor*
CLYDE FITCH, *Managing Editor*

Prepared Especially for the Radio Service Man!

NEVER in the history of radio has there ever been published a service manual, so complete, as this new OFFICIAL RADIO SERVICE MANUAL. It is a veritable encyclopedia of service information—worth several times its price. It is invaluable not only for the Service Man, but for everyone interested in radio.

$3.50 A COPY

There has been collected for this manual wiring diagrams and data of nearly every commercial set, of which there is any available record, manufactured since 1927, and many earlier ones.

The OFFICIAL RADIO SERVICE MANUAL is made in loose-leaf form in a handsome, durable, flexible leatherette binder and contains 352 pages of the large size, 9 x 12.

Additional service data for new receivers, as they appear on the market, will be published and supplied at a trifling cost so that the MANUAL may be kept up-to-date at all times. But that is not all.

SERVICE INFORMATION

The OFFICIAL RADIO SERVICE MANUAL contains also a most comprehensive instruction course for the radio Service Man, giving practical information from every angle on how to service the set. Here are only a small number of the articles mentioned:

- Amplifiers (Audio and Radio)
- Automotive Radio
- Antennas
- Condensers
- Detectors
- Eliminators
- Meters
- Power Supply Systems
- Radio Phonograph Equipment
- Resistors
- Short-Wave Sets
- Speakers
- Tubes

THE BIGGEST RADIO VALUE IN AMERICA TODAY!

You simply cannot realize what a tremendous work this is until you have held a copy in your hands and have gone through its 352 pages.
Over 1,000 illustrations, diagrams, etc.

WHAT THEY SAY

NOTHING CAN COMPARE WITH IT

I have received my copy of the OFFICIAL RADIO SERVICE MANUAL. I expected it would be good for I think you know as much as any of them what the average radio man wants, but I'll wager not very many expected to receive a book comparable to this one. I think you deserve a lot of credit for being the first to put out a real service manual that the amateur or professional can make good everyday use of. It's a good practical book and one that every service man will be proud of.—E. D. HANA. Haslett, Mich.

BEST BOOK IN THE FIELD

I received your book OFFICIAL RADIO SERVICE MANUAL and I find it is as yet the best book I have found in this field of radio. You are well justified in that this is the peer of service manuals. I wish you all the success possible in the publishing of future books on radio which are sure of great necessity.—WILLIAM R. BROWN, Brown Radio Service, 1010 Buckingham Street, Toledo, Ohio.

WORTH A GREAT DEAL MORE

Received your copy of OFFICIAL RADIO SERVICE MANUAL and am greatly pleased with same. It is worth a great deal more than it costs.—HAROLD AIGUIER, 41 Rutland Ave., Arlington, N. J.

"SHE IS A BIRD"

Just to let you know we received my MANUAL this A.M. and—OH BOY!! She is sure a BIRD! You sure did strut your stuff, AND HOW!!—V. H. HERNDON, Herndon's Radio Shop, Odon, Indiana

EXTREMELY PLEASED

I acknowledge receipt of the OFFICIAL RADIO SERVICE MANUAL and I am extremely pleased with it.—EDW. JOHN SMITH, 337 E. 26th St., Erie, Penna.

A VERITABLE GOLD MINE

I received the OFFICIAL RADIO SERVICE MANUAL. I am well pleased. It is a veritable gold mine for the Service Man.—EUGENE BINFORD, Arkansas City, Kansas.

MAGNIFIQUE

Received my copy of the OFFICIAL RADIO SERVICE MANUAL this A.M. "She is what you call him! Magnifique! Exquisite!" A timely aid for the troubled sets. Thanks.—E. BOICE, 1118 W. Dauphin, Philadelphia, Pa.

FINEST THING

Just received the RADIO MANUAL. It sure is the finest thing I have seen.—E. J. SCHWARM, 465 Eddy Road, Cleveland, Ohio

IT ASTOUNDED THEM

Everywhere I have exhibited the MANUAL it has taken the boys by surprise and its completeness has astounded them. For instance, Saturday morning last I had occasion to run into the service plant of the Mackenzie Radio Corp., New York District Distributers for Zenith Radio, in connection with replacement units, and when I showed the Service Manager, Mr. Wandelt, the MANUAL, he was agreeably surprised and called the men to see the work. Delightedly yours, and always a booster for Gernsback Publications, of which I read practically all, and study them.—IRA C. HALDERMAN, 44 Leroy Place, Ridgewood, N. J.

MAIL COUPON TODAY—

PUBLISHERS OF "RADIO"
428 Pacific Building, San Francisco, Calif. R-11

As per your special offer, I enclose herewith $3.50 for which you are to send me postpaid, one copy of the OFFICIAL RADIO SERVICE MANUAL.

Name .....

Address .....

City ..... State .....

present them at the earliest possible time. In this manner, I believe, we can prepare the public for future tightening of installation standards.

Privately Owned Equipment

THIS item constitutes, and is the source of, approximately 65 per cent of all interference. For the most part this type of interference is highly intermittent in character and difficult to trace.

Legislation has been most effective in silencing the greater portion of this in Southern California. Twenty-eight ordinances are now in effect in that part of the state.

However, interference creating equipment is constantly being manufactured and marketed. The public is buying this merchandise in ignorance of the fact that it may disturb the radio reception of their entire neighborhood.

I should urge this body to make recommendation to the N. E. L. A. and the N. E. M. A. that manufacturers be requested to install condensers, chokes or filters, at the time of manufacture, on all equipment and apparatus susceptible to such corrective measures. In this manner we can eventually check the influx of apparatus capable of becoming obnoxious to the radio listeners, through wear, abuse or neglect. I should suggest that a committee be appointed to draft a list of manufacturers, and products, falling within the above category.

Dealers

RADIO has attracted, for the most part, a younger type of merchant. The majority have not had sufficient capital, or the necessary merchandising background to meet the complex and ever-changing problems incident to successful radio retailing.

Service demands, interference, and a multiplicity of other things peculiar only to the radio industry, have reduced net profits to the point where dealers cannot be expected to devote much time to costly interference investigations, even if they were capable, which they are not.

As to the distributor of a commodity which has produced, and will continue to produce, a revenue for power utilities, a dealer is entitled to your fullest cooperation. This will be dealt with further in the following paragraph, and in the summary.

Complaints

IT HAS been our experience that the greater portion of complaints originate immediately after the sale. Usually this type of report is of greatest importance to dealers.

A potential sale is pending and prompt action, with the assurance that every possible relief will be afforded, is the deciding factor in countless sales. I believe this type of complaint should have preference.

DX complaints on either the short wave or broadcast bands, should give way at this time in favor of complaints involving reception from near-by stations.

Complaints involving obsolete or homemade receivers usually call for the service of a repair man. I believe our energies should be devoted to the correction of interference concerning modern broadcasting receivers.

Centralized clearing houses for complaints are desirable from every standpoint because they disclose groupings, which point out affected areas.

COMPLAINT QUESTIONNAIRE

This complaint will not be honored unless completely filled out by your radio service man and returned to the Radio Trades Association, 1301 Commercial Exchange Building, Los Angeles, California. This information is vital, and every question must be answered intelligently.

1. Name ....., Address ....., City .....
2. Phone ..... Near what intersection .....
3. House ..... Duplex ..... Apartment ..... Number of apartments in bldg. .....
4. What stations do you receive satisfactorily? ....., ..., ..., ..., ...
5. What stations would you like to receive and cannot? ....., ..., ..., ..., ..., ..., ..., ..., ..., ..., ..., ..., ..., ..., ...
6. Make of receiver ....., Model ....., Electric ....., Battery .....
7. When purchased ....., From ....., City .....
8. Last serviced ..... By ....., City .....
9. Outdoor antenna ..... Indoor ..... Antenna and ground plug in wall .....
10. Grounded to water ..... Gas ..... Or if independent ground ..... How deep .....
11. Length of antenna including lead-in ..... Length of ground wire .....
12. Stations heard with antenna and ground disconnected ....., ..., ..., ...
13. Describe interference in your own words .....
14. Have you personally heard interference complained of? ..... When? .....
15. Is interference steady or intermittent? ..... What time on? .....
16. Will the complainant spend the necessary money to install shielded lead-in and ground wires if our investigator recommends it? .....
17. Write here any suggestions you may have as to what you think we can do to give this complainant satisfactory *local* reception .....
18. Have you personally checked this installation and do you certify that you have done all you are able to do to correct it? .....

Firm name ..... Address ..... City ..... Phone .....
Service man inspecting ..... Date inspected .....
Is inspector a certified service man? .....
Office record: Date complaint received ..... Questionnaire mailed .....
Questionnaire received .....

Owing to the cost of investigations, and the number of set failures contacted, we, in Southern California, subscribe unalterably to the questionnaire form, copy of which is attached. We believe that the information requested is essential, and that no one should be entitled to coöperation who will not reciprocate to the extent asked. Neither do we believe that further steps should be taken when questionnaires develop the fact that unreasonable distance requirements are to be met or the set is improperly installed. In such cases, the complaint should be filed, and the complaining party so advised by letter, telephone, or by personal call.

Utilities

UTILITIES can quite properly be segregated into two classifications: Those that profit directly or indirectly through the operation of radio receivers, and those that do not. May we forget the second group for the moment, and discuss only the first.

Unquestionably the advent of radio has presented a new problem to utilities. A new factor has been added to the service standards of the commodity they distribute. Unfortunately, it is a most intangible factor. Only the most elementary principles of radio interference are understood. Causes are so diversified that no construction or maintenance standards are interference proof.

In outlying sections, where signal strength is low, years must elapse before lines and equipment can be placed in such shape that the radio listening public can expect to have consistently good radio reception.

When the most experienced investigators are unable to place responsibility for interference, it is not surprising that the inexperienced public blames the nearest thing at hand. The real problem is to locate sources and pacify the listeners while we are doing it.

Complaints to utilities regarding radio interference should have, and, for the most part, do have, an equal significance with other complaints involving service. While it is true that utility responsibility ends at the meter, the public do not realize that fact at this time.

Traction companies are in a rather difficult position in the matter of interference. Radio produces no revenue for them, and, of late years, automobiles and busses have made such serious inroads into their revenue that retrenchment is the order of the day, but radio interference from street car equipment does not carry with it into the receiver any plea of extenuating circumstances.

Summary

THE radio industry is young, aggressive, and filled with possibilities for future progress. Interference must be removed to make way for the advancement in both development and

(Continued on Page 63)

Circuit *Analysis* of *Radiola* 80 Series

THESE are superheterodyne receivers, employing one r-f stage with a 224, a 227 oscillator, 224 first detector, two intermediate stages with 224s, a 227 in the second detector, two 245s in the push-pull audio frequency and a 280 rectifier.

The antenna inductance is high in value in order to minimize the effect of variations in the antenna system. Coupled to it is a tuned circuit, called the link circuit, which is designed to eliminate cross talk and increase the selectivity. This is tuned to the same frequency as the r-f stage and detector. The tuned r-f stage follows, the cathode voltage being obtained from the drop in the 170-ohm resistor and added to by the drop in the parallel resistors which separate the 170-ohm unit from ground.

Thus when the 4000-ohm volume control is used in its entirety the resistance of the two parallel units is 2400 ohms. When the resistance used in the 4000-ohm unit is reduced the resulting total resistance is just a little less than it would be without the shunt. An 18,000-ohm bleeder resistor separates the cathode from the screen grid. The plate of the first tube is fed through a high inductance coil so that the tube will give good amplification. The output is coupled to the grid of the first detector through a very small condenser.

The oscillator is tuned in a manner similar to the other tuned stages, with a network of series-parallel trimmer condensers for the purpose of making it track with the others. Its output is inductively coupled to the first detector grid, and oscillation is set up within the circuit by means of a feed-back inductance. Although the cathode goes to ground through a 2000-ohm resistor there is no grid bias here because the grid is not returned to ground but to the cathode.

The first detector receives the output of the r-f tube and that of the oscillator, which is tuned to a frequency 175 kc off that of the former. Thus the detector output is at this intermediate frequency. The detector grid returns to ground, getting its bias from the 2000-ohm resistor between cathode and ground, and the plate is fed through the tuned primary of the first i-f transformer. A local-distance switch in this circuit shunts a 40,000-ohm resistor across the primary for local reception, and at the same time removes the shunt from a 500-ohm resistor in series with the secondary coil and condenser, thus reducing the sensitivity about 40 times and decreasing the value of selectivity just enough to improve the quality a bit. The exact effect of this switch is shown by the dotted lines in the performance curves. The cathode of the first i-f tube is brought to the same point as that of the r-f tube, which means that the volume control resistor varies the bias on the first i-f tube as well as the r-f amplifier.

The second r-f stage is exactly the same as the first with the exception of the "local reception" resistors. The grid bias is taken from the 2000-ohm resistor in the cathode circuit.

The second detector also employs the plate rectification principle, the cathode resistor being of the value of 10,000 ohms. A .0024 μf condenser is connected across the plate and cathode, forming, with the r-f choke in the plate circuit, an r-f filter circuit. The grid circuit of the second detector is, of course, tuned

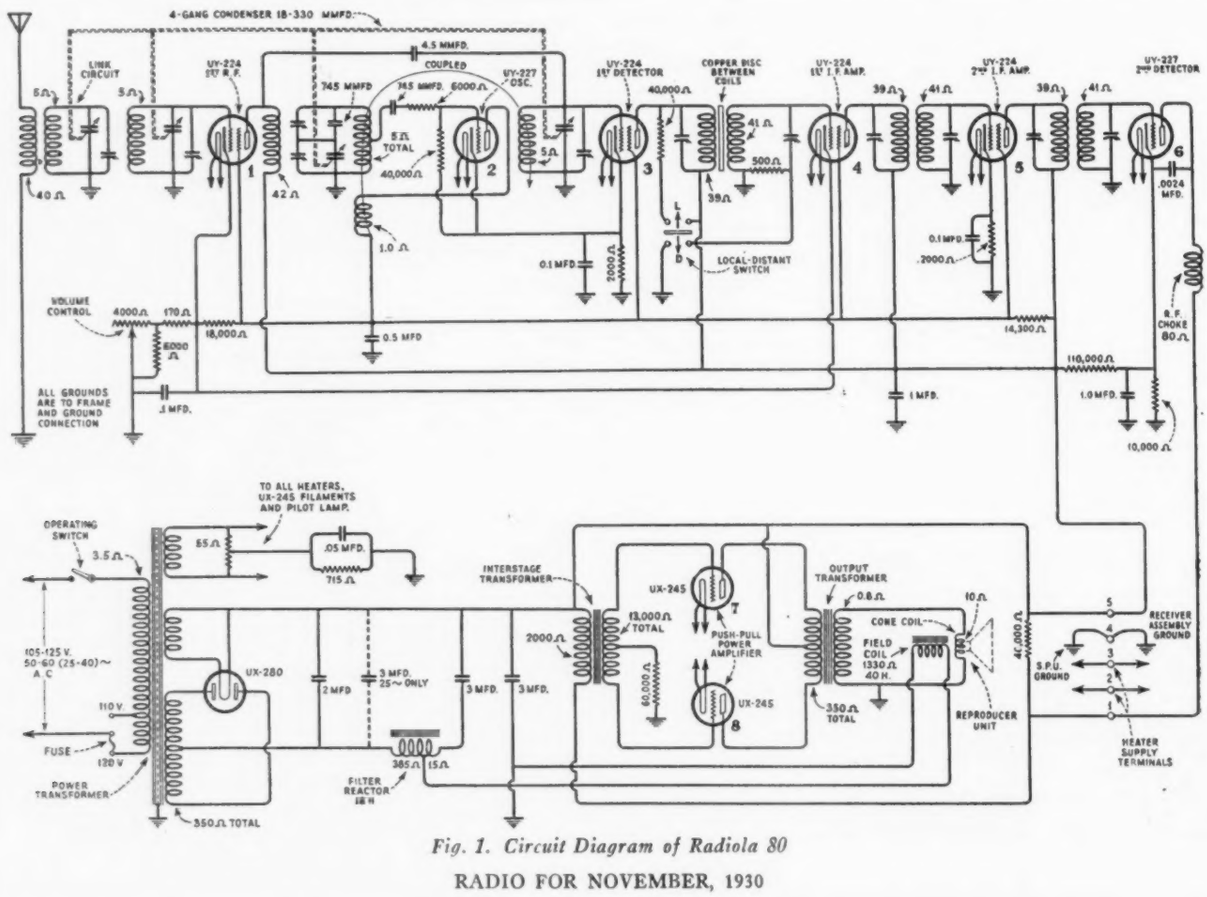
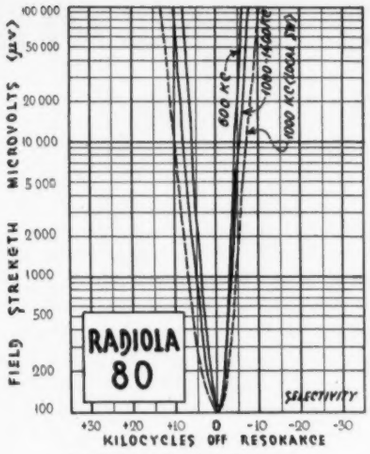


Fig. 1. Circuit Diagram of Radiola 80

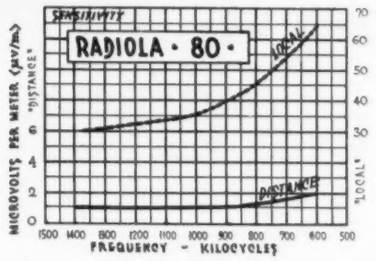
Performance Curves of Radiola 80



Radiola Selectivity Curves

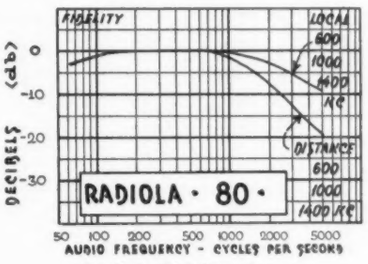
THE selectivity curves of the new Radiola line are not only surprising, they are almost unbelievable. The superheterodyne type of receiver has always held the reputation for being the most selective of all receivers, although this contention has not been accepted universally. There seems to be little room for argument now, however, and it would not be surprising to see the tuned radio frequency circuit follow its ancestors within the next couple years.

Note that there is practically no difference in the Radiola's selectivity at the different frequencies. It is stated that the curves of most of these receivers will fall along identical points, which is perfectly possible, the receiver tested being taken from stock with no more than a cursory trimming.



Radiola Sensitivity Curve

AS A matter of interest the sensitivity curve of the Radiola 80 was taken with the local-distance switch thrown to one side, then to the other. As shown, the sensitivity for distance reception is about thirty times that for local use. From 1 to 2 microvolts per meter sensitivity is splendid.



Radiola Fidelity Curves

THE fidelity of the Radiola 80 is fine, also. By design, the selectivity has been sacrificed a bit on local reception in order to reduce the effect of side-band cutting and increase the quality of the high notes.

to 175 kc, the variable condenser shown being a trimmer.

All plates, with the exception of the oscillator, are supplied from the same line, the oscillator plate taking its voltage from the line that feeds all screen grids. A 14,300-ohm resistor reduces the plate voltage to the necessary amount for screen grid exitation, and a 110,000-ohm bleeder between the plate line and the detector cathode resistor (thence to ground), serves to stabilize the voltage.

The power supply unit contains a transformer with but three secondaries, all heaters and filaments being connected to the same 2.5-volt winding. The 715-ohm resistor between the center-tap of the resistor which shunts this winding and ground supplies the grid bias for the 245 tubes. The filter circuit has one a-f choke that is divided into two sections. If there is any a-c voltage in the first section of the reactor it is induced in the second section through the transformer action of the choke. It is, however, 180 degrees out of phase with the first voltage, and tends to cancel it. The speaker field winding is used as the second a-f choke. The full output of the filter is supplied to the plates of the 245 tubes, as well as to the plates of the other tubes, with the above-mentioned exception. The simplicity of the voltage supply system throughout is strikingly shown by the fact that only five terminal posts are needed, even including the heater terminals.

Rectifier A-C Meters

W. N. Goodwin, Jr., chief engineer, Weston Electrical Instrument Co., has recently written a paper on rectifier type instruments. As this contains information of interest to those who read J. Edward Jones' article on "A New Test Panel for the Shop" in October, 1930 Serviceman's Supplement to RADIO, a brief abstract is here presented of some of the salient features of the paper.

This type of instrument is used principally to measure a-c of too small a magnitude to be measured by means of the usual a-c instruments. Its accuracy is not as important as ruggedness and ability to withstand heavy overloads.

It consists of a d-c instrument (Weston 301 type) used with a rectifier consisting of four sets of copper oxide discs arranged in a Wheatstone bridge circuit as shown in Fig. 1. Thereby each half of the a-c wave is rectified and passes through the meter in the same direction. The meter indications are proportional to the average values of the wave and not to the squares of the instantaneous values, as in the case of the ordinary a-c meter. It can be calibrated, however to give R.M.S. values for a pure sine wave. Any variation from a pure sine wave form introduces more or less error.

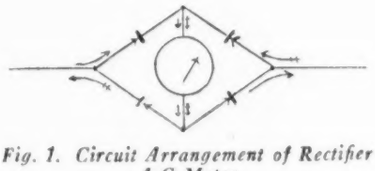


Fig. 1. Circuit Arrangement of Rectifier A-C Meter

The errors due to temperature change between 64 and 95 degrees F. are not likely to exceed 2 per cent. Indications decrease at the rate of about 0.5 per cent for each 1000 cycles, increase in frequency up to 35,000 cycles per second. It is better adapted for measuring current or voltage in high than for low resistance circuits.

The approximate resistances of various types of Model 301 instruments at full scale and at 0.3 scale are as follows:

Range	*Full Scale*	*0.3 Scale*
500 microamperes	710 ohms	1540 ohms
1 milliampere	440 ohms	930 ohms
2 milliamperes	290 ohms	590 ohms
5 milliamperes	180 ohms	325 ohms

If the circuit under test has a low resistance, say 1000 ohms, the total circuit resistance for a curent of 500 microamperes would be $1000+710=1710$ ohms. The indicated current would be $1000 \div 1710 \times 100 = 58.8\%$ of that which would have resulted if the instrument had not been in circuit. For a current of 150 microamperes the circuit resistance would be $1000+1540=2540$ ohms and the current indicated would be $1000 \div 2540 \times 100 = 39.4\%$ of what it would be without the meter in circuit.

"In general, if the instrument is used on wave forms closely approximating sine waves, such as found on lighting circuits, and if used at room temperature, the indications may be relied upon to within about 5% of full scale value. Errors due to frequency can be corrected."

Radio Interference

(Continued from Page 61

sales, which are inevitable. It would seem equitable to expect those who profit most from the operation of radio receivers to bear the major portion of the necessary educational and investigation programs involved.

Looking into the future, it is not difficult to interpret the signs of the times. Increased revenue will justify the expenditures. Public ill will is the spectre which constantly hovers about the corporation or individual who disregards the well-being of others. No program of any consequence looks as much to the present as to the future, and radio occupies a very definite place in the future of mankind.

Circuit *Analysis* of the *Howard* Screen Grid "A"

THIS receiver contains three tuned r-f stages using screen-grid tubes, a '27 detector, and a transformer coupled push-pull audio stage with '45s. An '80 rectifier is used.

The antenna is coupled to the grid of the first tube inductively, the primary of the coupling transformer being shunted by a potentiometer which is one section of the dual volume control. The other section of the volume control is a variable resistor connected between the three r-f cathodes and ground in order to add to the grid bias, therefore block the action of the tubes.

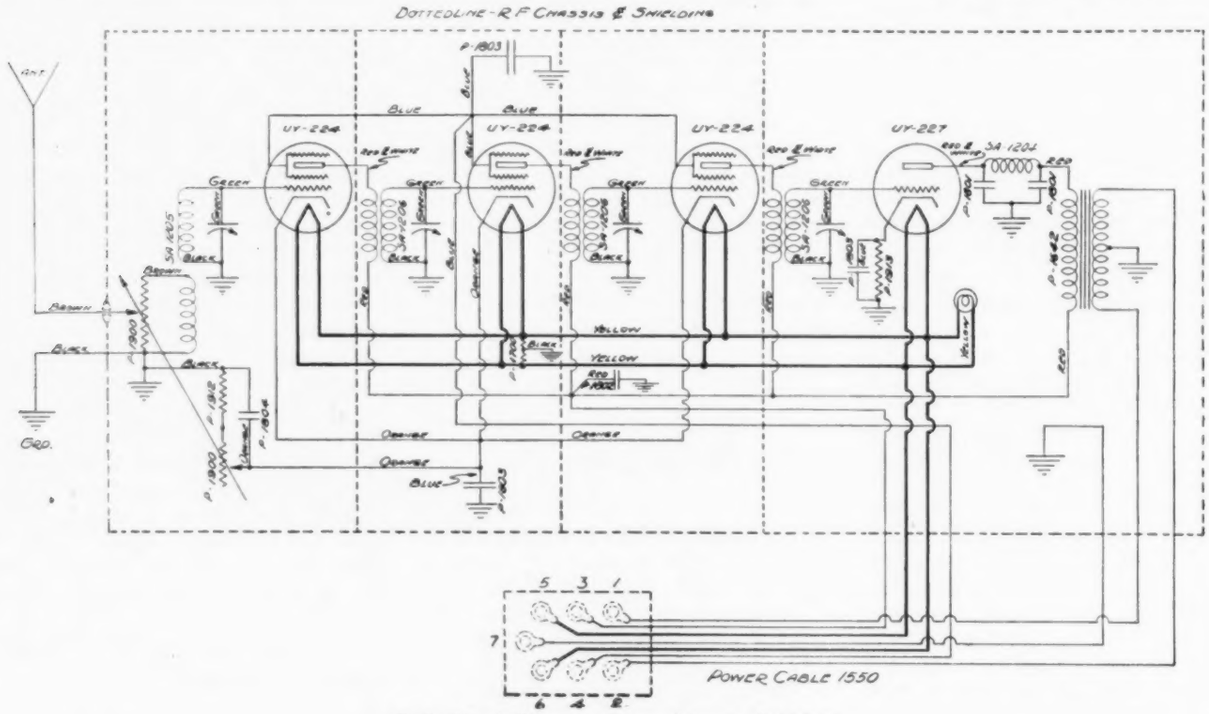
The plates of the three r-f tubes and detector are supplied from the high voltage line after it has passed through the speaker field winding, the voltage being 175 volts. This voltage passes through the primaries of the respective r-f transformers and, in the case of the detector, through the a-f transformer primary and the r-f filter choke. A bypass condenser, between the plate lead and ground, keeps the r-f and a-f currents out of the power supply system. The screen-grid voltage supply is taken from a tap in the voltage divider, located in the power unit. This is also bypassed.

The detector grid is biased by means of the voltage drop through a resistor between cathode and ground. The output of the detector is filtered of its r-f through an r-f choke and a small fixed condenser on each side. The choke impedes the passage of the r-f currents while the first condenser provides a low resistance path to ground. The condensers are too small to bypass the audio frequency currents.

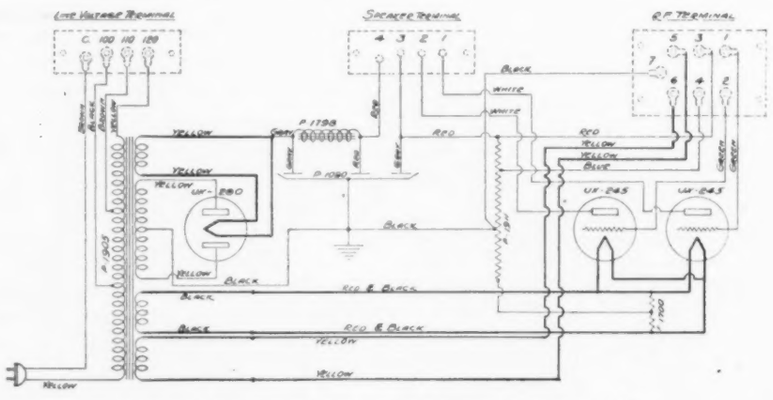
The center tap of the a-f transformer secondary is grounded, the ends going to terminals *1* and *2* of the terminal block, and from there to the two a-f grids. Bias for the a-f grids is obtained from the extreme negative section of the voltage divider, which separates the negative side of the rectified power supply or ground, from the center-tap of the filament shunt resistor. Nos. *1* and *2* of the r-f terminal connect the a-f grids to the secondary of the audio transformer, as mentioned. Nos. *3* and *4* supply the r-f and detector plates and r-f screen grids respectively; Nos. *5* and *6* the heaters, and No. *7* connects the power unit chassis to ground.

The primary of the power transformer is tapped for voltage adjustment. There are four secondaries; one

(Continued on Page 66)



R. F. Circuit Diagram, Howard Screen-Grid "A"



A. F. and Power Unit Diagram, Howard Screen-Grid "A"

? s That *Service Men* Are Likely to Meet in *Forthcoming Examinations*

By J. EDWARD JONES
President, Pacific Radio Service Managers' Association

Q. Explain differences between ether waves that impinge upon the antenna and sound waves that emanate from speaker cone.

A. Main differences are rate of vibration, and media through which they travel. Ether waves, using the so-called ether as traveling medium, move with the speed of light, or about 300,000,000 meters per second. Sound waves, using air as traveling medium, travel about 1100 feet per second.

Q. What is the principal function of a tone control? Explain different methods in use.

A. The principal function of a tone control is to bypass the high notes, thereby causing the bass to dominate, and give the acoustical illusion of more low frequencies. The principal methods in use are a number of different size condensers connected through a tap switch, and one definite capacity connected in series with a variable resistor.

Q. What values are usually used in the condenser-resistor tone control, and how are they connected in the circuit?

A. Where a single power tube is used a .002 mfd. fixed condenser is connected in series with a 500,000-ohm variable resistor between power tube grid and ground. Where push-pull, single stage audio is used, a .025 condenser in series with 40,000-ohm resistor is connected from detector plate to ground.

Q. Express simple formula for several condensers of equal size connected in series.

A. $C=\frac{C_1}{N}$ where C_1 is value of one condenser and N equals number of condensers connected in series.

Q. The '24 tube is known for its low interelectrode capacity and its ability to handle a greater transfer of energy without undue oscillation, yet this tube can be so operated as to be a very persistent and steady oscillator through a very wide band of frequencies. How is this done, and what is the principle called?

A. The static curve of the '24 type tube is peculiar and unusual when compared with the regular tubes. At certain low plate and high screen voltages, due to secondary emission from the plate, the tube has a negative plate resistance. A tube having such characteristics must be a persistent oscillator when connected correctly. This portion of the curve is called the dynatron portion. The plate voltages vary from about 20 to 40 and the screen from 90 to 200 volts, and with grid and cathode to negative B and with suitable values of inductance and capacitance forming an LC circuit in series with the plate, sustained oscillations from 30 to 2,000,000 can be obtained.

Q. What is the usual trouble when in testing from a certain tube socket in an inoperative set a high grid bias is found, but the plate meter shows no plate current? Explain in detail.

A. This is a common but misleading trouble. The real trouble is an open bias resistor, and in actual practice the tube has no plate return and of course no plate current. However, as soon as the voltmeter is connected in the circuit in an attempt to read the bias, the resistance of the meter itself becomes a temporary biasing resistor. This resistance is extremely high, causing very little current to flow, therefore the bias voltage may not read extremely high. If now the bias reading control button is released and the plate mil button pressed, no reading will be obtained, for upon releasing the bias voltage button the meter resistance, which was temporarily in the circuit, has been removed.

Q. What are the principal things to look for when the phonograph end of a combination is dead, but the radio end O. K.?

A. Open or shorted winding in pickup, frozen armature in pickup, open contacts in change-over switch, open or shorted wiring, and if a special input transformer is used, either open or shorted primary or secondary.

Q. What is one of the first things to look for in an ordinary t-r-f set when signals are very weak and accompanied with loud hum?

A. Shorted bias resistor of either r-f or audio tubes.

Q. Give formula for inductive reactance. Capacity reactance.

A. $X_L=2\pi FL$, $X_C=\frac{1}{2\pi FC}$ where π 3.1416, L is in henries, C in farads, F cycles per second.

Q. What is a watt? Express in terms of current and resistance, also current and voltage.

A. The watt is the practical unit of power. $W=I^2\times R$, $W=I\times E$.

Q. Which combination is capable of the greatest undistorted output when operated at the maximum allowable peak grid swing—two '45 tubes in push-pull or two in parallel?

A. The allowable grid swing on tubes in push-pull is much greater than on two in parallel, therefore the push-pull could produce greater undistorted output.

Q. With 5 volts a-c on their grids, which would produce the greatest output—two '45 tubes in push-pull or two in parallel?

A. Two tubes in parallel can produce greater output than two in push-pull when the input signal voltage is less than the value of the normal bias of one tube.

Q. When increasing the range of an ammeter or a milliameter, what must be known and what formula is used to determine the value of the shunt?

A. The internal resistance of the meter in question must be known; also the shunt material must be sufficiently large to carry the load, the resistance value of the shunt can be determined from the following formula:

$R_1=\frac{R_2}{\frac{I_1}{I_2}-1}$ where R_1 equals value in ohms of shunt, R_2 equals internal resistance of meter in ohms, I_1 equals total value of current in amperes, and I_2 equals maximum current through meter in amperes.

Q. What is the resistance of the heater of 227 tube?

A. Ohms law: $I=\frac{E}{R}$, $E=I\times R$, $R=\frac{E}{I}$ substituting $R=\frac{2.5}{1.75}=.7$ ohm.

Q. The mutual conductance of a '27 tube is 1000 micromhos, while that of a '24 tube is 1050. With so proportionally slight a difference, why is it the amplification factor of the '24 is 420, while a '27 is only figured as 9?

A. The following will explain: Amplification factor equals mutual conductance times plate impedance. It can therefore be seen that the plate impedance is really responsible for the mu.

Q. In substituting a condenser in the filter system of a power supply where replacement of same type and make cannot be made, what are the principal conditions that must be fulfilled?

A. Firstly, voltage rating. The voltage to which the replaced condenser will be subjected must be determined, and one chosen with a voltage rating about 25 per cent higher than normal filter voltage. This will be reasonably safe, and not unnecessarily expensive. Secondly, the capacity should be about right. If this cannot be determined exactly, it is usually safe to use a 2 mfd. in the first stage of the filter and a 4 mfd. in either of the other two stages.

Q. What is the principal function of by-pass condensers?

A. To complete, to shorten, and to isolate r-f circuits; to pass r-f currents around resistors and around chokes and primaries of audio transformers.

Q. What is the principal cause of so-called line hum, differentiated from the usual hum caused by poor filtering?

A. This type of hum is usually caused by poorly grounded neutral of power supply.

Q. What effect has extreme selectivity upon tone quality, and how can this effect be noted in the output of the speaker?

A. Extreme selectivity in the r-f circuits cuts the side bands, that is, cuts off and eliminates the high notes. This effect is responsible for the deep, tubby, unnatural reproduction heard from some receivers.

Q. What is the common cause of a receiver failing to start operation until four or five minutes after being turned on, but will operate perfectly for hours after once starting?

A. This condition is more prevalent in sets using screen grid tubes and is caused by an internal short in the tube.

Q. What is the principal cause of oscillation in a TRF receiver, and give various remedies.

A. The principal cause is energy feed-back between the plate circuit and grid circuit of the various tubes. This feed-back is most troublesome across the grid-plate capacity of the tube. This parasitic capacity can be neutralized and its effect nullified by various methods, the best known of which are the Hazeltine and Rice methods of neutralizing. These methods, however, are but makeshifts, for they do not remove the unwanted capacity, but merely neutralize its effect by taking an equal amount of energy from some other part of the circuit and cause it to oppose the feed-back energy across the tube capacity 180 degrees out of phase. This does, however, increase possible efficiency, as it allows closer coupling between succeeding circuits, therefore greater transfer of energy from one circuit to the next.

Q. Explain the functon of a magnetic pickup?

A. An electro-magnetic pickup consists essentially of an iron vane placed in an air gap between the poles of a permanent magnetic, the vane being extended to hold a needle. The needle running in the groove of a record follows the sound vibrations previously recorded in the groove, thereby causing the vane to move back and forth in the magnetic field. This movement causes currents of like frequency to be set up in the coil which feeds into some form of amplifying system and reproduces the tones in the loudspeaker.

Howard Screen Grid "A"

(Continued from Page 64)

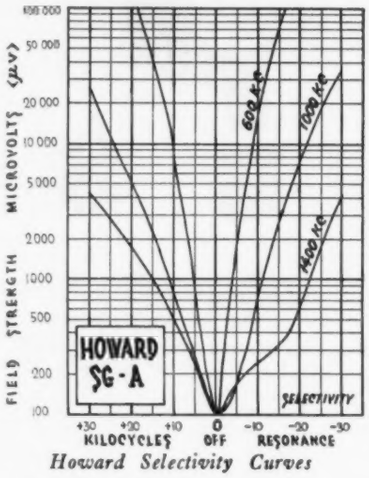
for high voltage, one for the rectifier filament, one for the power tube filaments and one for heaters of the r-f tubes and detector. One a-f choke and the speaker field winding, with a filter condenser at each end and at the junction between the two, constitute the filter system. The output transformer is mounted in the speaker frame.

The chassis is divided into three portions, one housing the variable tuning condensers and tubes, one containing the r-f transformers, and the third containing all tube sockets, bypass condensers and chokes. The tuning condensers are not ganged on a single shaft but are mounted in a row, one beside the other, and controlled by pulleys and phosphor bronze belts. Each condenser and associated tube is completely shielded from all other parts of the circuit, and each r-f transformer is enclosed in a copper shield can that is easily removable.

Lyric Automatic Self-Tuner

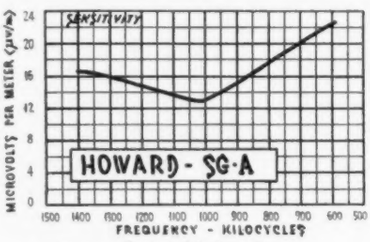
The new Lyric automatic, self-tuning, 24-hour model includes an electric clock which may be set to turn on or off any one of nine desired stations at any pre-determined time. This is accomplished by means of two discs, one provided with nine pegs and the other with notched levers corresponding to each 15 minute interval.

Performance Curves of Howard Screen Grid "A"



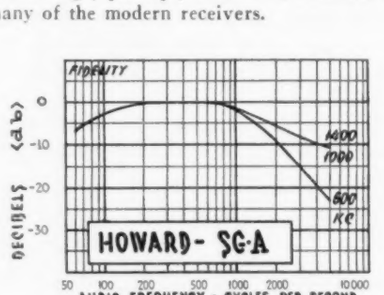
Howard Selectivity Curves

It is hardly fair to show the Howard selectivity curves alongside those of the Radiola superheterodyne, but a comparison with other t-r-f receivers will show that the above stand up pretty well. While the selectivity is nothing to shout about it is sufficient for the average listener; in fact for anyone but the distance hound, who isn't supposed to be much of a factor these days. The jog in the right leg of the 1400 kc curve indicates that one of the circuits of the particular set tested was slightly out of line.



Howard Sensitivity Curve

The sensitivity of the Howard Screen Grid A receiver is just average; sensitive enough, perhaps, but not as sensitive as many of the modern receivers.



Howard Fidelity Curves

The Howard fidelity curves indicate that very good tone quality is possible, especially at frequencies above 1000 kc. A drop of 11 decibels at 5000 cycles is not much of a drop, while the highs are dropped only 24 decibels when the set is tuned to 600 kc. It must be remembered that there are very few, if any, actual fundamental tones at these frequencies, or even above 1000 cycles. The ability to pass these frequencies without too much attenuation is necessary, however, in order to permit fullness of tone (not to mention static and needle-scratch).

Radio Consideration *in Apartment and Office* Building Construction*

By NILS E. BORCH

Radio Interference Engineer, Pacific Radio Trade Association

Preliminary Considerations

WHENEVER a radio receiver is installed in an apartment or office building, special consideration must be given to its installation. Usually such a building contains many large sized motors and other electrical appliances. These motors and appliances are arranged for automatic or interrupted service and so become potential sources for radio interference.

It is a well-known fact that any metallic body, such as power, telephone, telegraph, doorbell and alarm systems; steel girders, metal chimneys, metal roofs; water, gas and heating pipes, etc., will, under certain conditions, become re-radiating systems for any radio wave impinging upon them. Another known fact is the production of radio frequency oscillations at the point of make and break of an electric circuit and also whenever a spark is taking place between two points of a high tension system. These points being granted, it is easily seen that a multitude of possibilities for interference exists in apartment buildings. Below are listed the most common sources of interference in such buildings:

Automatic Oil Burning Furnaces and Water Heaters

THE majority of these devices utilize a high tension electric spark to ignite the oil. When the furnace goes into operation a spark at approximately 12,000 volts jumps across a special spark plug inside the furnace. This spark lasts all the way from fifteen seconds to two minutes, the length of time dependent upon the individual adjustment. The time interval between the furnace operations depends directly upon the temperature of the building and the amount of hot water being drawn from the water system. Usually during the day the spark will appear at about thirty-minute intervals, while in the evening about every ten or fifteen minutes.

The high tension spark is supplied from a transformer feeding directly from a 110-volt power line. A motor to operate the blower is also used. This motor generally is of the repulsion induction type with commutator and brushes. If this motor is in first-class condition very little, if any, interference is caused by it. After having been in operation for some time, and if not given the proper care in oiling of brush springs and bearings, the brushes may make an intermittent contact to the commutator and thus set up interference which will be noticed in all a-c receivers in the building as clicks or as a series of clicks and scratches.

The interference from such a furnace may be caused by magnetic leakage, electro-static radiation and direct line feedback; of these, a magnetic leakage may ordinarily be disregarded. The electro-static element is a direct radiation away from high tension leads leading into the spark plug in the furnace and is only an interference factor if these leads are unshielded, and if the walls and ceiling of the furnace room are unshielded. The modern furnace uses shielded leads and present day construction of furnace rooms calls for complete covering of furnace walls and ceiling with sheet iron, which effectively prevents interference by radiated energy.

The most troublesome source of interference is that from the direct line feedback, but this is also the easiest to prevent. By electro-static action part of the energy of radio frequency currents, generated at the spark plug, is transmitted into the power line where, partly by conduction and partly by radiation and re-radiation, it works into radio receivers in the building and radio reception may be entirely ruined from this source. A filter properly designed and connected close to the power leads of the high tension transformer will prevent this feedback, and should in all cases be installed if tenants are to be kept satisfied with radio reception. Many commercial filters for this purpose are to be had; therefore, constructional details need not here be discussed.

Automatic Ice Machines

THE motor operating this device goes into operation when the temperature falls to a certain predetermined degree. The commonly used motor is the repulsion-induction type. When running at full speed this motor operates as an induction motor and will not cause any radio interference. However, it starts at full load, and the starting current is, therefore, comparatively heavy and may cause a fluctuation in the building line voltage unless separate power leads from the line are used. The bearings of the motor, if not properly oiled, may become worn and the brush springs so sluggish in action, that an intermittent contact is made between brushes and commutator, which causes severe interference. A line filter will prevent this interference from reaching the receivers in the building. Proper aerial installation and receiver line filter or power transformer electro-static shield will also keep the interference from these devices from being objectionable.

Elevators

PERHAPS the main source of interference in apartment and office buildings is that of elevators, both on the alternating and direct current. These elevators use many automatic controls and circuit breakers, and, therefore, many hundreds of points of make and break contacts exist with resultant possibility for setting up of interfering radio frequency oscillations. The interference created by elevators is broadcast into aerials and ground wires of near-by receivers from the controller cables leading to the elevator car. These cables must of necessity be flexible and, therefore, without any metallic covering of any kind. If they could in some way be electro-statically shielded, little if any interference from elevators would be present, but with the present construction they are very good radiators of radio frequency currents flowing along them.

The interference from the elevators is produced at the following points:

a. The brushes rubbing against commutator of motor.

b. The automatic control relays.

c. The circuit breakers.

d. The elevator door controller contacts on each floor.

e. The elevator speed controller.

From these sources radio frequency currents are transmitted into the car cables and from there radiated into surrounding space and so picked up by near-by aerial and ground systems and also by any exposed portion of the house wiring, which, in turn, will act as re-radiators of the interference until it finally reaches the radio receivers either by conduction or by pick-up of re-radiated impulses on the aerial ground systems of the individual receivers. Due to the fact that so many sources of interference are present in an elevator system, the cost of filtering out the individual sources would be prohibitive, and the only practical method is therefore to filter the individual car controller cables. Unfortunately, the specifications of the National Board of Fire Underwriters expressly forbid connecting any

*Paper presented at October 29th meeting of California Radio Interference Association.

device such as a condenser across the line of these cables. The reason for this is, of course, that if the condenser should for any reason break down, the contact would be made and the car would start going up or down, the direction of motion depending upon which of the condensers had broken down, or, in other words, which of the controller cables have become short-circuited with the breaking down of the condenser.

Any attempt at filtering must, therefore, be approached from an inductive standpoint only, that is, by means of certain arrangement of choke coils forming oscillatory trap circuits and tuned to the frequencies of the interfering oscillatory currents. Such a circuit without the use of condensers would, unless constructed from heavy copper wire and with consequent bulkiness, introduce considerable resistance in the line, and so be impractical. There is a possibility that an arrangement of pancake wound coils placed in bucking relation to one another and with their flat surfaces close together, will introduce sufficient capacity between them, so that such a filter may be constructed in a practical way, and at the same time present no objectionable features to the National Board of Fire Underwriters. Much experimental work along this line is needed, and it is hoped that the various elevator manufacturers by concerted action will in the near future be able to solve the problem of elevator interference by some such means. It might here be mentioned that in the case of Class A buildings with practically complete shielding of all electric wiring and appliances, the resultant interference from elevator and other local sources is of no moment. Even in the case of extreme interference such as that from "Diathermy" devices, the shielding in Class A buildings is sufficient so that the interference may be successfully prevented by the application of local receiver filters placed in the power suppy leads to the receiver.

Door Bells, Door Openers and Intercommunicating Phones

THE voltage used in these devices is very low and interference due to make and break in the circuits is caused only if aerial lead-in and ground wire are run close and parallel to the circuit wires. No filter is needed here. Separation of leads will do the trick.

Dial Telephone Systems

WHEN a number is called on a phone of this type a great number of sliding contacts are made and broken at the relays. These makes and breaks set up radio frequency currents in the phone circuits. Result: Waves are radiated from the wires and may be picked up by aerial lead-ins and ground wires or by lines supplying power to radio receivers and so eventually be transmitted into the receiver proper. Where telephone wiring is done in lead cable little interference of this nature is produced except where it comes from the parallel flexible cord to the phone so as to cause a series of clicks from the loudspeaker. Aerial lead-ins or exposed power wires should therefore never be run close and parallel to telephone wires. The telephone companies will install an interference suppression unit wherever there is such interference provided the aerial and ground system for the receiver is properly designed and installed.

Individual Electrical Appliances Utilizing Motors, Thermo-Couple Elements and Electro-Therapy Devices

Electric water heaters	Electric heating pads and blankets
Hair dryers	Flashing buttons
Automatic irons	Vacuum cleaners
Electric heaters	Violet Ray
Floor waxers	Flashing signs
Diathermy	Washing machines
Dishwashers	Fan motors
Battery chargers	Electric ranges
Vibrators	

These devices and many more not enumerated are to be found in apartment buildings. Since for their principle of operation they depend either upon a make and break in the circuit or a high tension spark between points, it is readily seen that severe interference may be the result of their operation unless proper prevention is taken. Suitable filters installed at the interfering device will of course greatly reduce the interference, but where a great number of devices are installed the cost of suppression by this means is prohibitive. Here again proper aerial-ground construction will help materially in keeping interference at a minimum. This subject is mentioned in more detail in a later paragraph.

Building Electrical Constructions

Partial ground in house wiring.
Loose contacts in attachment plugs.
Partial grounds in flexible lamp cords.
Loose ground connection in other aerials.
Any two metallic bodies rubbing together.
Imperfect switch blade contact at main service.
Imperfect contact between fuses in branch blocks and contacts proper.
Loose connections in service switch and branch blocks.
Loose ground wire from neutral of power service to water pipe.
Loose connection of wire connecting metal conduits to ground.
Loose wire or contacts at wall switches in building.
Loose telephone ground to lightning arrester and water pipe.
Partial grounds on other aerial systems in building.
Loose joint in house wiring.
Defective light fixture.
Loose light in fixture sockets.
Loose joints in other aerials.

All lights and electrical devices must, of course, be controlled by means of suitable switches. Here again we have circuit makes and breaks. Filtering in this case is out of the question. The only means for reduction of such interference is by proper locating and proper construction of aerial and ground. The same is true of interference produced by defects in house wiring and equipment. Having seen from the above the thousands of potential sources of radio interference existing in apartment buildings, it is rather surprising that any reception whatever is to be had, particularly so when the average radio installation is considered.

Aerials and Grounds in Apartment Buildings

IF A radio receiver were designed to pick up energy of waves from broadcast stations by means of re-radiations from power and other lines, the radio receiver manufacturers would not provide aerial and ground binding posts for the receivers nor would they give definite specifications for aerial and ground construction in the booklet sent out from the factory with each set. There must, therefore, be a definite reason for these specifications, which is that present-day receivers are designed for pick-up of broadcast station signals solely by the aerial and ground. In fact in many modern receivers an electro-static shield is incorporated in the power transformers to prevent as much as possible any radio frequency oscillation, both from broadcast stations and from interference sources, from entering the receiver proper by capacitance coupling through the power transformer which is connected directly to the power line.

The importance of keeping radio frequency oscillations from entering by this means is not as yet realized by the radio trade in general nor by some of the manufacturers of radio equipment. In this electrical age it should be definitely understood by everyone connected in any way with the installation of radio receivers that *the only pick-up for any radio receiver should be on the aerial proper* and preferably on the flat top portion of the aerial.

The aerial lead-in is usually in close proximity to metallic bodies such as power, telephone and signal system wires; water, gas and steam pipes; and metal girders, metal chimneys, etc., all of which are potential re-radiators of radio frequency waves. Picking up of signals from broadcast stations by such re-radiations causes broadness of tuning and in receivers near powerful broadcast stations causes what is known as "Station Riding." But the worst feature of an unprotected lead-in installation in apartment buildings is that interference from any make and break in the electric circuits throughout the building will have free access to the receiver, and so produce reception which is not worth listening to.

In nearly all apartment house aerial systems inspected, the aerial has been found to be a wire coiled around the ceiling of the room in which the receiver is to be located with lead-in run down

inside the wall to convenient baseboard outlet. The modern apartment house in nearly every case uses steel girder frame construction, and, in many cases, stucco fronts with associated metallic screen for holding the stucco in place. And in the case of Class A buildings the metallic reinforcement concrete construction adds more radio frequency screens.

These metallic bodies constitute a more or less perfect shield for the waves from broadcast stations, and it can, therefore, readily be seen that an aerial placed well within such metal construction will have little if any pick-up. In fact many cases have been found where more pick-up was had when the aerial was disconnected and the ground wire connected directly to the aerial binding post of the receiver, thus showing that more energy is transmitted into the receiver by direct earth conduction than was being picked up by the house aerial.

Considering all these factors detrimental to radio reception and applying a little common sense to choice of aerial location, there remains only the roof of the building as the place for the erection of the flat-top portion of the aerial. None other whatever should even be considered, if tenants in buildings are to be kept satisfied. Since most of the interference is being picked up on the lead-in some method of prevention of this pick-up must first be found if satisfaction is to be assured. This can only be accomplished by metallic shielding around the lead-in and ground wire. Several methods to this are here suggested:

1. *RCA Centralized Radio Aerial*

In this system but one ordinary aerial flat top is used, and the radio frequency energy so received is distributed throughout the building to wall outlets in the individual apartments. From these outlets the usual aerial, ground and power line connections are made to the tenants' radio receiver. A maximum of eighty radio receivers of any type or manufacture can be operated simultaneously from one roof aerial for the reception of programs selected at will, and without interaction or mutual interference as many more extensions can be accommodated by use of a second aerial. The undesirable effect of a long or crooked lead-in, such as is necessary to reach the ground floor of a tall building, is avoided, and tests have shown that, in some cases, stations can be received by means of this system, which, otherwise, would not be heard at all.

2. *Multicoupler Aerial System*

A system of the above name has been developed by the radio engineering firm of Amy, Aceves & King, Inc., New York City. It comprises a well designed and suitably located common or group aerial provided with lead-ins to which as many as fifteen separate receivers may be connected by means of specially designed coupling devices known as Multicouplers. The bottom end of the lead-in is provided with a suitable terminal resistance unit and lightning arrester. A number of common or group aerials may be installed on the roof, with the respective lead-ins, to supply the requirements of the largest apartment building. For an eighty family apartment house, as an example, only six group aerials with their respective lead-ins are required, as against eighty separate aerials which would otherwise have to be used.

3. *Shielded Lead-in Aerial*

An individual shielded lead-in aerial will, of course, require an individual flat-top on top of the roof. This would seem rather hopeless in large apartment buildings, but tests have shown that flat-top portions may be erected as close together as one foot, without any interaction between them unless some of the receivers are of the oscillating types with resultant radiation of radio frequency energy into surrounding space. Such interference will, of course, cover several hundred feet surrounding the aerial to which it is connected. The modern receiver does not radiate from the aerial, and oscillating receivers are very rare and need not here be considered. The shielding for above construction can be done by means of metal conduit or metallic braid wire such as the "Belden braid," made specially for such installation. A very good description of this system, by H. L. Parker, can be found in the August, 1929, issue of RADIO. A structure similar to that used on clothes racks on top of the roof may readily be incorporated in the building plans for use as aerial supports so as to present no great difficulty from an architectural standpoint and also not to detract from the beauty of the building.

Radio Installation Requirements in Large Buildings

1. The aerial-ground system should be so arranged that the entire signal pick-up is had on the flat top portion of aerial on top of the roof.

2. Flat top portion must be arranged to be free of the field of magnetic or static radiations.

3. It must be installed to comply with specifications of National Board of Fire Underwriters and local City Ordinances pertaining thereto.

4. All lead-ins and ground wires must be shielded.

5. Lead-in and ground wires should preferably be run down in the outside wall of the building.

6. Lead-ins should never be run down elevator shafts.

7. Elevator shaft should be lined with metal, as likewise pent house on roof if such is used.

8. Furnace room should have walls of metallic construction.

9. Automatic furnace must have local filter built in close to high tension transformer.

10. Service wires to outside power line connections should be of ample size to avoid appreciable resistance drop in voltage when large motors in building go into operation.

11. The owner of building must make sure the transformer capacity to building is ample to handle intermittent and steady load without fluctuation in house voltage.

12. Radio installation should be made by men who are familiar with factors involved.

13. All metallic bodies in building and on top of roof should be grounded. This includes stucco screen if such is used.

Grounds

PRACTICALLY the same factors as those in aerial construction must be considered in selection of ground connections for the receivers in an apartment building. The ground should preferably be made to a metallic body buried deep enough to assure contact to moist soil. The water pipe system may be used, but since this pipe is a common connection for one side of the neutral wire of the power line and the telephone ground, serious interference may at times be transmitted directly or by re-radiation into the receivers. If a water pipe system is used for a ground the connection to the pipe should be made as close as possible to where the pipe comes out of the ground. A copper wire will always have less effective resistance than the iron water pipe, no matter how far it has to run. That the ground connection from the receiver is at the point of contact between ground wire and water pipe is an erroneous impression. Actual ground connection is not made until contact with moist soil is effected. To prevent pick-up or re-radiated impulses the ground wire, in the case of an independent ground, should always be of the shielded braid or lead type, or conduits if the occasion demands. The shield then must be connected to the water pipe system and the wire itself to the ground rod or independent ground wire.

If the factors mentioned in the accompanying summary are taken into consideration and installation made accordingly, very few complaints of radio interference will be heard, and relations between tenants and owner will be much better. Seventy-five per cent of the population of the country are more or less interested in radio reception and a tenant in an apartment house who has invested considerable money in a radio receiver is not going to be satisfied to stay at a place where all reception is accompanied with scratches, clicks and buzzes.

Rough *and Ready* Diagnosing

By HENRY BURWEN

IN THIS day and age of fine test kits, modulated oscillators and vacuum tube voltmeters, service men are often prone to take a service problem too seriously. Each has his regular method of going about the job, until it becomes a religion with him to start at the beginning and follow through step by step until the trouble is found or his routine is completed. Sometimes the obvious is ignored in the quest for the deep, dark mystery.

A case comes to mind that occcurred some time ago before the days of the electric set, but still is apropos. One of my service men, a young fellow of three or four years' experience, had taken out a Freshman set and phoned back that he couldn't get a peep out of it; the set was defective. He was therefore ordered to bring it back and was sent out with a duplicate, tested carefully for precaution's sake. Again the same report—everything apparently O. K., but no singee, no talkee—the set must be N. G. In desperation and disgust I told him to wait there while I jumped into a car and hastened out. A cursory examination indicated all connections O. K. Immediately came out the voltmeter—our only testing instrument at the time—and test made across the binding posts. Aha, what's this? A battery reversed? Nevertheless, A plus ran to the red post and A minus to the negative post. Down to the battery went the voltmeter, which instantly revealed that the battery, though new, was improperly marked, the negative post having been painted red. In two minutes the set was playing its soulful music and all departed pleased.

The important point of this incident is that had the service man used his common sense he should have reasoned at once that it was against the laws of probability that two sets in succession would be defective and would surmise that the trouble would have to be in the accessories or connections. It is this kind of quick diagnosing I mean when I say that a little exercise of gray matter usually points at least to the general source of the trouble.

The simple voltmeter of a few years ago has been displaced by a set analyzer, but although I carry one to every job I find it necessary to use it but rarely—perhaps eight out of ten cases are diagnosed and cured by simple observation and quick reflection that enables me and I presume anyone else who uses the old bean but slightly to spot the trouble almost directly.

A few further instances may not come amiss.

Case No. 1—Complaint set dead. Location eight miles from nearest broadcasting station. Turning set on and adjusting dials I found it was not actually dead, that broadcast could be brought in very weakly, tone quality pure, tuning very sharp. Set showed tendency to oscillate, adjustment for station very fine. Immediately antenna leaped into my mind. Disconnected antenna, put finger on antenna post. No result. Switched ground wire to antenna post, set produced normally, taking into consideration weak pickup of ground. Obviously trouble was in the antenna and must be close to the set, as a shorted antenna or a poor contact between flat top and lead-in would have had some pickup and brought it in stronger. Traced lead-in back from the set. First stop at the window, six feet from the set. Wiggled Fahnstock connections on lead-in strip. No result. Disconnected wires from strip, joined the two together. Hurrah, music! Lead-in strip broken under insulation. Job done. Time, ten minutes. Set analyzer superfluous.

Case No. 2—Symptoms similar, but pick-up and volume greater because located in city near broadcasting. Room recently papered and painted. Traced the aerial. Ah, here it was. Wires attached to lightning arrester on baseboard near radio. Lead-in had been changed over to ground post of arrester, evidently fault of painters. Trouble cured.

Case No. 3—Set had suddenly become weak on distance. Tone quality normal. Set seemed to tune a trifle broadly and had little gain when volume control was turned up. Tried interchanging r-f tubes with a new 27. No improvement. Switched ground over to aerial, set became normal. Inspected aerial. Traced back to window. Everything O. K. Took a look outside. Ah, the house had recently been painted, and although it was gathering dusk it was easy to see where insulators, lead-in wire and all had been painted over, partly grounding out the signal.

Case No. 4—Music weak and broken up. Set tuned normal, brought in the station, didn't appear to be exceptionally broad or exceptionally sharp, but no gain at all on turning up volume control. (Sharpness of tuning is most important to observe as it often indicates the nature of the trouble.) Must be a bad tube. Most likely to be the detector tube. Why? Because a weak r-f tube will still show some gain on advancing volume control and would affect broadness of tuning. Likewise a weak audio tube would still show gain. Diagnosis strengthened by the fact that detector tube in set is one of a sample lot of cheap tubes we tried out that were giving us more or less trouble. Detector tube replaced first, set played O. K. Goodbye. Customer all smiles. Why bother the set analyzer? *Diagnosis picks the most likely candidate first.*

Case No. 5—Loud howl from set until warmed up, when it played normally. Sounded like a lion roaring at the zoo. Shut set off; turn on again; no noise, everything nice. Must be a tube and most likely the detector or an audio output tube. Look before you leap to the set analyzer is my motto; set analyzing uses up time. Waited for tubes to cool thoroughly. Swung set out from wall, switched on and watched the tubes while they were warming up. Ho, here was one of the 45s all purple and blue inside and again the loud roar. Tube gradually cleared, became normal color and noise subsided at the same time. Replaced the 45. Waited again five minutes for tubes to cool off thoroughly in case I might be fooled. Turned on set, everything O. K. Set analyzer undisturbed. Trouble cured. Time 20 minutes.

Case No. 6—Set absolutely dead, tubes lighted. Question customer. Set was playing all right night before, but next morning wouldn't go. Inspected tubes. All looked normal, all of first quality, set only four months in use. Pull out detector tube—speaker clicks. Try ground to antenna post—no result. Well, here at last was a job for the analyzer, which had been getting impatient at its idleness. Obviously r-f trouble. Plugged in first on the 24 tube—hung the shield cans on this Philco set where you have to fish in blindness to match up with the socket holes. No *B* voltage, no *C* voltage, and of course no plate current. Tried the other 24. Same indications. Tried the output tubes; 180 volts of *B*. Thought they used 250 volts on these output tubes. Well, if they do, that was subnormal and there was a short in the set. Out comes the chassis. This was no job to be done in the customer's home—into the shop she went. The trouble? Oh, yes. A common lead to the r-f plates was shorted to a copper sheath through which it ran. Well, the old analyzer is some good, after all!

Case No. 7—A Robin Hood chassis made by Pierce-Airo. Chassis had just come from factory, where it had been sent to have a new filter condenser block installed and given to customer to take home in its original box as received.

(Continued on Page 72)

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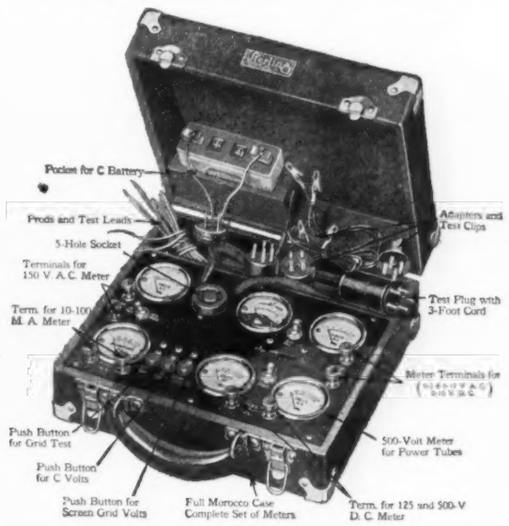

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MAKERS OF STERLING CONCERTONE RECEIVERS

Rough and Ready Diagnosing

(Continued from Page 70)

Next day customer reported, "Set terrible." On arrival found set working, but reproduction weak, distorted and chopped up. Hardly any use fooling with the tubes because we had tested those in the store when customer first brought his chassis in for repair. All tubes in proper place, everything looking normal. Wiggled the tubes. No result. Well, a bum detector tube *could* cause such action; try a new one anyway. Just the same. Had to use the analyzer on this job. Ha! 50 volts on all the 26s, 25 volts on the detector. Something wrong; looked like a bum 80 tube, still there was a full 180 volts on the 71-A output tube. Seemed hardly possible, but just for good luck we tried another rectifier tube. What ho, the set played O. K.! But I tested that rectifier tube personally in the store and it still *looked* O. K. Put it back. Set still played O. K.! Well, what was the mystery? Don't know; decided to put it down as one of those cases we frequently cure without just knowing what particular thing we affect. Put back power pack cover, which we had removed for easier insertion of rectifier tube. Set was bad again! That durned cover was doing it. A minute's experiment and we found the cover, when pressed home, contacted some of the bank of resistors on top of the filter block. Pressed them down slightly and called it a day.

Case No. 8—Emerson set using four 27s and one screen grid detector. Set played O. K., but had a loud hum. Very abnormal; sounded like the drone of an airplane high up in the air. Hum present whether tuned to station or not. All other action normal. Well, well, perhaps these anlyzers were more useful than I thought they were. Brought it out. All voltages normal. What was the most likely conclusion? Must have something to do with the power pack. Off came the cover. Mershon condenser. Wiggle it. Hum stopped. Well, that was easy; must have been poor ground contact between Mershon can and chassis. Tightened up the bolts. Presto, hum started again! That was queer. Tried a positive contact—soldered wire from can to chassis. Hum sometimes stopped, sometimes started with handling. Tried tightening contact nuts on top of condenser can. Same action. Well, anyhow, we were getting warm, literally and figuratively. It wasn't the ground contact nor contact at the lugs. Only thing I could figure was a defective condenser. Took chassis to shop. Next morning complaint on another Emerson. Same symptoms, same diagnosis. Back to shop. Fortunately the Mershon manufacturers were close to us. Sent condensers over to them. Diagnosis confirmed, condensers replaced, sets O. K. Much satisfaction all around.

I could go on more or less indefinitely, but these examples will show what I mean by going after the first thing first. Practical everyday run of service in the home doesn't require in each instance a thorough detailed analysis nor the filling out of analysis sheets. It usually requires just a rough and ready diagnosis to begin with. Some preliminary indication shows in most cases. In the instance of the broken lead-in strip it was the fact that the set acted normally in every way except that it was very sharp and very weak. Why look for trouble or analyze the set when the set acts O. K.? In the case of the shorting power pack cover the "conditions precedent" (as the scientific individual would express it) were that the chassis had just come from the factory supposedly repaired and in spite of indications the chances were that it was O. K. Perhaps two cases out of ten require expert scientific analysis, study with the set analyzer, experiments and continuity testing. The other eight simply require application of a modicum of that common sense which is really quite uncommon.

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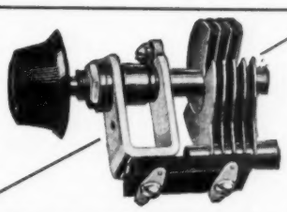

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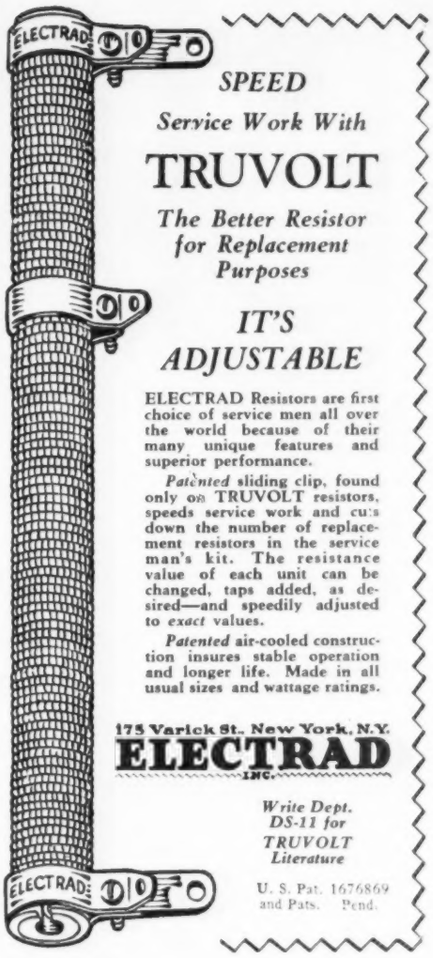

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